

Final Report



**Resource
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Corporation**

Financing Worldwide Electric Power: Can Capital Markets Do the Job?

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TABLE OF CONTENTS

EXECUTIVE SUMMARY	ES-1
Worldwide Capital Needs	ES-2
Evolving Sources and Methods of Financing	ES-3
Can Capital Markets do the Job?	ES-5
CHAPTER 1 - INTRODUCTION	1-1
Objectives	1-2
Approach	1-2
Organization of this Report	1-3
CHAPTER 2 - WORLDWIDE INVESTMENT IN THE ELECTRIC POWER INDUSTRY, 1995-2010	2-1
Forecast Approach	2-1
Investment for Power Generation	2-4
Transmission, Distribution, and General Investments	2-10
Sensitivity Analysis	2-11
Context for Worldwide Capital Needs	2-16
CHAPTER 3 - EVOLVING SOURCES AND METHODS OF FINANCING	3-1
Financing the Evolving Global Electric Power Industry	3-1
Sources of Capital	3-5
Financing Methods	3-14
How Capital is Raised for the Electric Power Industry	3-18
CHAPTER 4 - GLOBAL CAPITAL MARKETS FOR ELECTRIC POWER	4-1
Capital Markets by Region	4-1
International Funding Sources	4-3
Domestic Private Capital	4-10
CHAPTER 5 - CAN CAPITAL MARKETS DO THE JOB?	5-1
Power Sector Needs for Private Sector Financing	5-1
Perspectives on Electric Power Financing	5-3
Barriers to Private Financing	5-5
Mitigating Barriers to Private Financing	5-15
GLOSSARY	G-1

LIST OF TABLES AND FIGURES

<u>Tables</u>	<u>Page</u>
ES-1 Cumulative Worldwide Electric Power Investments by Region, 1995-2010	ES-2
ES-2 Projected Cumulative Private Sector Investment in Electric Power for Developing and Transitional Countries by Region, 1995-2010	ES-5
2-1 International Energy Agency Regional Definitions	2-2
2-2 Projected Worldwide Changes in Generation and Generating Capacity by Region and Energy Source, Cumulative for Period 1995-2010	2-3
2-3 Cumulative Worldwide Electric Power Investments by Region, 1995-2010	2-5
2-4 Capital Needs by Use and Country Type	2-7
2-5 Capital Needs by Investment Category	2-11
2-6 Cumulative Worldwide Electric Power Investments by Region, High Growth Scenario, 1995-2010	2-12
2-7 Cumulative Worldwide Electric Power Investments by Region, Clean Coal Technology Scenario, 1995-2010	2-14
2-8 Investment in Coal by Type of Technology, 1995-2010	2-15
2-9 1991 Gross Domestic Investment (GDI) and Electric Power Needs in Developing Countries	2-18
2-10 Capital Flows to Developing Countries	2-19
2-11 1991 Foreign Direct Investment (FDI) in Developing Countries	2-20
2-12 1992 Gross Domestic Investment (GDI) and Electric Power Need in Developed Countries	2-21
2-13 WEC Projection of Cumulative Capital Spending for Energy, 1990-2020	2-22
3-1 Recently-Privatized Electric Power Industries	3-3
3-2 Estimate of Power Sector Financing for Developing Countries	3-6
3-3 Selected Investment Funds for Power Sector Developments, 1995	3-12
3-4 Methods Used to Finance Electric Power	3-15
3-5 Characteristics of Power Sector Functions	3-18
4-1 Private Investment in Developing Countries	4-2
4-2 Net Foreign Direct Investment Flows to Developing Countries	4-4
4-3 Net Portfolio Equity Flows to Developing Countries	4-6
4-4 Net International Bond Issues by Developing Countries	4-8
4-5 Net Commercial Lending to Developing Countries	4-9
4-6 Net Domestic Private Investment in Developing Countries	4-11
4-7 Characteristics of Domestic Capital Markets in Developing Countries	4-14
5-1 Projected Cumulative Private Sector Investment in Electric Power for Developing and Transitional Countries by Region, 1995-2010	5-2
5-2 Projected Cumulative Private Sector Investment in Electric Power for Developed Countries by Region, 1995-2010	5-2
5-3 International and Domestic Private Capital Market Requirements of Stakeholders	5-9
 <u>Figures</u>	
ES-1 Estimated Power Sector Financing for Developing Countries	ES-3
3-1 Financing Sources and Methods by Project Risk and Fund Availability	3-20

EXECUTIVE SUMMARY

This report addresses the ability of financial markets to fund the global expansion of the electric power industry anticipated over the period 1995-2010. The report focuses on the world's developing and transitional countries, where the most investment is expected to be made and where the greatest financing uncertainty exists. It answers the question: *Can private financial institutions and markets meet all of the anticipated needs to develop electric power worldwide?* It identifies constraints that may inhibit private financing and suggests actions for mitigating these barriers.

The U.S. Department of Energy, which sponsored this study, has a special interest in clean coal technologies which reduce the environmental impacts of coal use for power generation. The specific issue faced by many of these technologies is whether they can be financed, given the capital cost premium they impose for enhanced environmental performance and higher efficiency.

Electric power is critical to the economic and social well-being of the modern world. Facilities providing electric power are key to a country's infrastructure and are typically one of the first components to be put in place. Yet, the provision of electricity is perhaps the most capital-intensive of all economic activities, requiring massive investments in power generation, transmission, and distribution systems and related facilities.

Unfortunately, over one-third of the world's people do not yet have electricity. In addition, the population of developing countries continues to expand rapidly. Significant electric power development is anticipated throughout the world over the next 15 years. Developing countries in East Asia, the Pacific Rim, especially China, South Asia, and Latin America are experiencing rapid economic growth — and this expansion is mirrored by an increased use of electric power in these regions. Developing countries in other parts of the world also see electricity as necessary to their economies. Over the next 15 years, they will be looking to make major additions to their electric power infrastructures. At the same time, the transitional countries of Central and Eastern Europe and the Newly Independent States of the former Soviet Union will be making substantial upgrades to their power systems to bring them to world standards. The developed countries of Western Europe, North America, and the East Asia-Pacific Rim region will also expand and upgrade their power systems.

This report concludes that the electric power industry can be privately financed in individual countries only if those countries create the conditions to attract private investment. Adequate capital is available worldwide, but there are many competing uses for this capital. Attracting capital to the electric power industry will require creation of electric power industries in each country that are run according to sound business principles, removal of barriers to both domestic and international capital, and reconciling of the often-divergent perspectives of the many parties involved in financing. Many countries are already creating these conditions. Doing all this, however, will be difficult in many other countries and the necessary conditions will probably not be created in some.

Clean coal technologies will be used in many countries, but financing the current incremental capital cost may be difficult for some. Expanding the market for these technologies will depend largely on the priority governments give to environmental concerns and the success of efforts to reduce the size and impact of the incremental capital cost by developing less costly clean coal technologies or to lower the cost of financing that capital increment.

WORLDWIDE CAPITAL NEEDS

Table ES-1 summarizes projected worldwide electric power investment through 2010 based on International Energy Agency "business-as-usual" projections of economic growth and energy supply and demand.¹ A total projected investment of approximately \$2.3 trillion is needed to finance global electric power sector expansion between 1995 and 2010, averaging \$152 billion per year. About 68 percent of this total — \$1.5 trillion — will be needed in developing and transitional countries. Developing countries have higher growth rates for population, industrial production, and power consumption than developed countries. While large amounts of capital must be raised, this investment will also stimulate economies throughout the world and create a huge market for goods and services related to electric power development.

Table ES-1
CUMULATIVE WORLDWIDE ELECTRIC POWER INVESTMENTS BY REGION, 1995-2010
(Billion 1993 Dollars)

Investment Type	North America	Latin America	Western Europe	China	OECD Pacific Rim	East Asia	South Asia	Central & East Europe	Newly Indep. States	Middle East	Africa	World Total
Generation												
Solid Fuel	94	22	102	222	51	100	71	19	24	2	27	734
Natural Gas	32	23	89	1	14	41	13	10	33	27	16	298
Oil	1	8	1	0	0	1	1	7	2	2	6	29
Nuclear	6	3	8	18	39	21	6	3	26	0	0	129
Hydro/Renew	17	52	15	67	5	6	48	5	13	3	5	235
Subtotal	149	108	215	308	108	169	139	44	98	34	54	1,426
Other Investments												
Transmission	14	42	20	31	10	28	23	3	14	4	12	200
Distribution	54	36	78	84	39	61	60	11	30	10	19	480
General	14	17	20	43	10	17	21	6	14	5	7	173
Subtotal	82	94	118	159	59	105	103	19	58	18	38	854
Total	231	202	333	467	167	275	242	63	156	52	91	2,279
Annual Average	15	13	22	31	11	18	16	4	10	3	6	152

SOURCE: Resource Dynamics Corporation estimates based on 1995 World Energy Outlook, Capacity Constraints Scenario, base case (Paris, France: International Energy Agency, 1995).

Since coal continues to be the most widely-used energy source in the world, one-third of all investments will go to coal-fired plants, including investments in clean coal technologies in many countries. Investments in gas-fired capacity are also expected to be large in most parts of the world. In addition, China and Latin America are expected to add considerably to hydroelectric capacity.

These projections of capital requirements are derived from inherently uncertain long-term energy supply and demand forecasts. Economic growth has a major impact on capital requirements. For example, worldwide growth in electric power averaging just 0.4 percent per year higher through 2010 could add \$600 billion of

¹International Energy Agency, 1995 World Energy Outlook (Paris, France, 1995).

investments—a 26 percent increase. Significantly greater-than-anticipated penetration of clean coal technologies would greatly increase the efficiency of power supply and reduce environmental impacts, but could add up to \$135 billion in capital requirements, about 6 percent more. The development and deployment of lower-cost clean coal technologies would allow many of these benefits to be realized with less added capital required.

EVOLVING SOURCES AND METHODS OF FINANCING

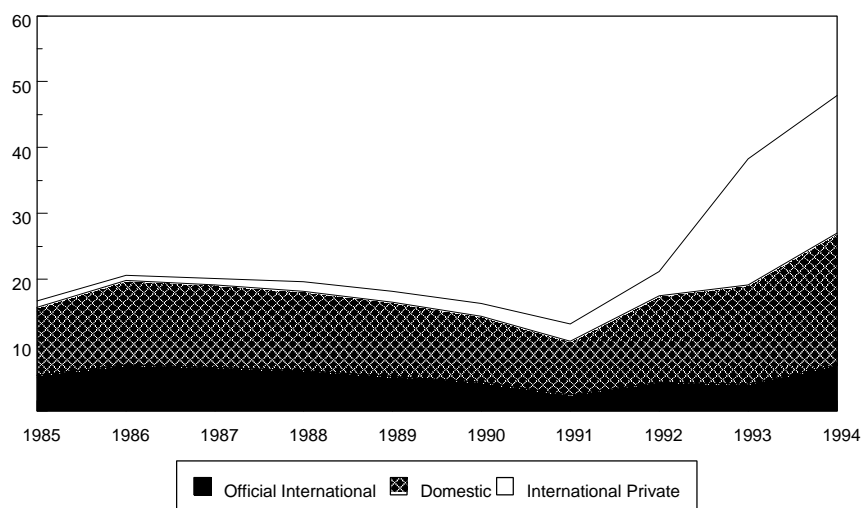
The restructuring of the global electric power industry is proceeding in several related directions: from government to private ownership, from monopoly utilities to a competitive industry, and from jurisdictionally-distinct entities to global players. These changes are stimulating parallel changes in the way the industry is financed: from official to private sources, from budget allocation to competition for capital, and from country or regional sources to global capital markets.

Capital for power generation can come from many sources, both public and private. The sources used depend on specific needs and underlying business conditions, which vary by country. Foreign capital comes from two general sources: official (government and multilateral) sources and international private investment. Domestic financing may also be part of power industry development. Figure ES-1 shows how sources of capital used for electric power in developing countries have changed over the last 10 years. It shows that overall capital investment has tripled over the last four years and the share coming from private capital market sources has increased dramatically. Official sources have been major providers of hard currency in developing and transitional countries. These are often preferred because

Figure ES-1
Estimated Power Sector Financing For Developing Countries
(Nominal Billion Dollars)

SOURCE: Table 3-2 of this report.

interest rates and payment terms are usually more attractive, and it is frequently required before other lenders will become involved. Three main sources of private international capital are available for electric power development: foreign direct investment, private lending, and stocks and bonds. Use of all three has grown



rapidly in the last decade. Domestic investment is essential to most power industry development. On average,

68 percent of power generation projects in developing countries have been funded by domestic sources.² In recent years, several trends have emerged:

- Official development assistance and multilateral lending are no longer solely sufficient,
- More private capital is going into power development worldwide than ever before,
- International equity investments are becoming more important financing sources,
- A blend of techniques and sources is used, reflecting how industry needs vary, and
- As the industry evolves, financing techniques also continue to change.

International Private Capital

While foreign direct investment varies among regions, it is increasing overall, totaling \$78 billion in developing countries in 1994. It is provided by project developers that build and operate power plants worldwide. Besides development firms, electric utilities also provide foreign direct investment.

Private financial institutions such as commercial banks lend money to many borrowers in developing countries. Financial problems in the 1980s, particularly in Latin America, induced many commercial banks to limit their participation in international markets. Recently, however, such lending has increased, including in electric power, but commercial lending has become less important than it once was in developed countries.

Stock investments take place when investors have access to equity markets offering stock liquidity. Closed-end country funds, insurance companies and pension funds from developed countries have been the largest sources of these equity investments. Recently, specialized mutual funds in developed countries have emerged which invest in developing- and transitional-country equity markets. While many investors view developing countries as too risky, this volatility may ultimately prove to be an advantage, since returns in developing-country markets are not correlated with industrialized equity markets and can produce higher returns. Bonds are by far the largest source of international debt for developing countries, accounting for 82 percent of all flows to developing countries in 1993.³ Bonds issued by government, local municipalities, and private or public firms are bought by investors worldwide. Traditionally, insurance firms and pension funds have been large investors in bonds.

Domestic Private Capital

Domestic private capital accounts for the largest share of total private investment in developing countries. It is a critical source of capital for electric power. Domestic investors typically have the greatest stake in, and knowledge of, their local power companies. In recent years, however, the domestic share of investment has declined as international investments have grown. Due to the diversity of cultures and economic systems among developing and transitional countries, capital market and institutional development vary widely. East Asia has the largest private capital markets in the developing world. This region has experienced rapid economic growth, fueling demand for capital. Recent privatizations and economic liberalization have attracted private capital to Latin America. In South Asia, while private domestic investment has declined, international private investment has risen rapidly.

²The World Bank, Energy Series Paper #21, "Capital Expenditures for Electric Power in Developing Countries in the 1990s" (Washington, D.C., February 1990).

³The World Bank, World Debt Tables 1994-1995 (Washington, D.C., 1995).

Small investors are a major source of capital for equity markets in developing countries. They usually welcome the opportunity to diversify their capital. Where permitted, foreign investors may also invest in domestic equity markets. Privatization has helped to create domestic equity markets in some countries by making available stocks in which to invest.

Local insurance companies and pension funds, where they exist, typically make a large share of the domestic stock and bond investments in developing countries. Such institutions facilitate the development of domestic capital markets. Bond markets in developing countries are often small, undeveloped, and dominated by government issues. A lack of rating agencies makes placement of private bond issues difficult. Domestic lending operations in developing countries are similar to those in developed countries, but usually offer shorter-term loans.

CAN CAPITAL MARKETS DO THE JOB?

Table ES-2 compares the total private investments expected to be made in developing and transitional countries from 1995 to 2010 to that needed for electric power development. Funding for electric power from official sources and domestic governments is projected to continue at roughly current levels. Private investment electric power is needed for what the official sources and governments cannot provide.

Table ES-2
PROJECTED CUMULATIVE PRIVATE SECTOR INVESTMENT IN ELECTRIC POWER
FOR DEVELOPING AND TRANSITIONAL COUNTRIES BY REGION, 1995-2010
(Billion 1993 Dollars)

Region	Electric Power Investment			Total Private Investment	Electric Power Percent of Private Investment
	Total	Official	Private		
Latin America	202	80	122	4,800	2.5
East Asia, China, Pacific	742	99	643	7,600	8.4
South Asia	242	25	217	800	25.8
Eastern Europe and Central Asia	219	47	172	1,500	11.3
Middle East	52	8	44	600	6.9
Africa	91	56	35	800	4.3
Total	1,548	315	1,233	16,200	7.6

SOURCES: Resource Dynamics Corporation estimates based on data in Tables 2-3, 3-2, 4-1, and International Energy Agency, 1995 World Energy Outlook (Paris, France, 1995).

Table ES-2 shows that 7.6 percent of all private sector investment in developing and transitional countries from 1995 through 2010 will be in the power sector. Whether this capital can be raised in the international and domestic capital markets depends on the answers to three basic questions.

Is enough capital available to meet funding requirements?

In developed countries, much of the basic electric power infrastructure already exists. Much new investment will go toward upgrading existing systems. The expected need for electric power investment is 1.1 percent of total projected private investment in developed countries. This is not large compared to the overall capital market, especially considering that investment in the electric power sector during recent years has been of similar magnitude. In addition, developed countries had real annual growth of about 2.8 percent during recent years⁴ and thus they should readily absorb the additional demand.

Table ES-1 projects large increases in electric power investment in developing and transitional countries for the period 1995-2010. The investment levels it shows represent a six-fold increase over the 1985 to 1991 period and a doubling of the 1994 level. Yet, of the total future private investment projected in developing and transitional countries, 7.6 percent is expected to be for electric power. By comparison, total real private investment in these countries has been growing at about 3.4 percent annually in recent years⁵. Hence, at current rates, the electric power sector's need for capital is equivalent to just over two years of projected growth in private capital investment in these countries. Enough capital should be available on a global basis, but needs for capital for electric power are high in some regions compared to current trends in total private investment. The fundamental issue is how to expand total private investment in each country with electric power receiving an appropriate and feasible share. Due to varying financial, economic, social, and political conditions, private capital will not necessarily be available for all anticipated electric power needs in all countries.

Can the perspectives of all concerned parties be reconciled to finance the industry?

Private financing involves matching the needs of governments, power sector entities and investors, each of which wants something different from the others. The issue is how to match these varying perspectives to finance an entire industry. The electric power industry is more than just an assemblage of independent power projects. It must perform and coordinate a series of functions — generation, transmission, distribution and supporting activities from initial planning through daily operations. As a result, financing of the industry must necessarily go beyond the financing of individual projects. What works for individual projects does not necessarily apply to the industry as a whole. **Three conditions are mandatory to obtaining private financing: (1) governments must commit to a financially independent electric power industry; (2) utilities must become economically viable and (3) investors must be convinced that their return requirements will be met.**

Reconciling divergent concerns is not easy. Differences are natural and make electric power financing difficult, even in developed countries. They are compounded in developing and transitional countries with long traditions of government control. Resolving the differences in these countries may be a long process. It will involve cultivating relationships and developing mutual levels of comfort for all the parties. It may not always succeed and, as a result, some power "needs" may not be met.

Governments, if they are interested in securing private capital, will have to remove domestic institutional barriers to agreements between parties, but, understandably, will only do so if their own needs are met. This is intrinsically political. In addition, removing barriers to agreements often involves a number of factors that may, at best, be only indirectly influenced by government agencies responsible for electric power. Yet, some countries are already taking the necessary measures and they will reap the benefits.

⁴International Energy Agency, 1995 World Energy Outlook (Paris, France, 1995), Table A2.

⁵Based on The World Bank, World Debt Tables 1994-95 (Washington D.C., 1995) and International Finance Corporation, Trends in Private Investment in Developing Countries 1995 (Washington, D.C., 1995).

Can the industry meet the criteria of the private capital sources?

To meet the needs of private capital investors, all three of the financing conditions noted earlier need to be satisfied — a financially independent industry, commercial viability, and investor confidence of adequate return. Several barriers may affect the available funding in some countries:

- Specific economic, political, or regulatory conditions may inhibit fulfilling all power sector needs.
- Not enough money may be available in domestic markets to complete development.
- Inadequate institutional infrastructure may exist to support capital formation.
- Inadequate financial market expertise may exist in the host government.

Specific barriers to creating a financially independent industry in some countries are:

- Government agency decision responsibility for the industry may not be clear.
- Excessive government approval requirements may stop or delay project completion.

Barriers to the formation of economically viable utilities in various countries include:

- An adequate market consisting of customers ready, willing and able to pay does not always exist.
- Electric power industry revenue is inadequate in some countries due to rates set below costs.
- Extensive power theft may make economically sustainable development difficult.
- Inadequate incentives may exist to retain competent managers in the electric utility industry.

Barriers may also reduce investor confidence that their return requirements will be met, including:

- Host governments policies are not always conducive to attracting domestic and foreign investors.
- A sufficient rate of return must be generated on each investment, but this may be beyond what host governments or utilities are willing to accept.
- Even with solid fundamentals, developers may face unfavorable financial market treatment.

Host governments must decide whether they really want private investment in electric power. **If so, they must commit to fostering the conditions necessary to facilitate it, and the investment will follow to the extent that economic conditions permit.** This obviously involves considerations for the host government that go well beyond the power sector. Also, the market for clean coal technologies is determined by the sensitivity of each country to health and environmental concerns and their willingness to pay the current incremental cost of clean energy.

In this situation, all that the United States Government, other developed country governments, and multilateral banks can do is to:

1. Encourage the governments of developing and transitional countries to create favorable conditions for private investment;
2. Where requested, provide information and advice to the countries desiring to facilitate these favorable conditions; and
3. Ensure that bilateral and multilateral funding sources are available to supplement private finance.

Strategies to promote private financing must take into account varying financial conditions in different countries. Several specific strategies can help overcome the barriers to private financing of electric power including clean coal technologies:

- Develop programs to bring together key players with differing perspectives on financing.
- Encourage host governments to facilitate a financially-independent electric power industry.
- Educate electric utilities in how to create commercially-viable utility businesses.
- Support multilateral aid to developing countries for privatization of electric power.
- Enhance programs to support sound economic principles in the power industry.
- Coordinate activities of United States agencies, other governments, and multilateral development banks to facilitate domestic and international private capital formation.
- Continue efforts to reduce the capital cost of clean coal technologies.
- Develop financing programs to reduce the current incremental cost of clean coal technologies.
- Assist developing and transitional countries to develop emission standards that promote environmental benefits.

It is currently anticipated that the next report in this series will address financing programs to reduce the incremental cost of clean coal technologies.

Chapter 1

INTRODUCTION

Electric power is critical to the economic and social well-being of the modern world. Facilities providing electric power are key to a country's infrastructure and are typically one of the first components to be put in place. Yet, the provision of electricity is perhaps the most capital-intensive of all economic activities, requiring massive investments in power generation, transmission, and distribution systems and related facilities.

Unfortunately, over one-third of the world's people do not yet have electricity. In addition, the population of developing countries continues to expand rapidly. Significant electric power development is anticipated throughout the world over the next 15 years. Developing countries in East Asia and the Pacific Rim (especially China), South Asia, and Latin America are experiencing rapid economic growth, which is reflected in their use of electric power. The developing countries in other regions see electric power as a prerequisite to desired economic growth. At the same time, the transitional countries of Central and Eastern Europe and the Newly Independent States (NIS) of the former Soviet Union must substantially upgrade their electric power infrastructures to bring them to world standards. Even the developed countries of Western Europe, North America, and the East Asia-Pacific Rim region are expected to expand and upgrade their electricity systems.

While the worldwide electric power industry undergoes these changes, the world's capital markets are being transformed as well. Now, along with the developed countries that traditionally have invested the most in electric power, developing and transitional countries are also seeking investment capital. In addition, the electric power industry is becoming more international and competitive as countries increasingly look to free markets — including capital markets — to meet their needs. As a result of these conditions and trends, capital for electric power will be provided more and more by private sources — not the government and multilateral sources of the past.

Most discussion on the need for capital to finance electric power in developing and transitional countries has focused on individual projects, countries or regions, and industry segments. A few successfully-financed independent power projects — whose number is small compared to the volume anticipated over the next 15 years — have received the bulk of attention. The broader question of whether an entire electric power industry can be financed to meet each country's expectations has rarely been asked. This question is pertinent because the traditional sources of domestic capital (government budget allocations and subsidies) and external capital (bilateral and multilateral financing) will not be adequate to meet the needs of the countries requiring the most investment. Concerns have also been expressed about the magnitude of the global need.¹ A recent U.S. Department of Energy Report to Congress, for example, projected a \$28 billion annual "gap" in financing of power generation in developing countries that could only be filled through private finance.² This places a new and large burden on the world's capital markets.

The United States has a significant stake in international electric power development since worldwide economic development, underpinned by electric power, helps promote a stable global economy. Within the electric power industry, the addition of free markets helps improve efficiency, lower costs, and expand opportunities. Also,

¹See, for example, Andrew Barnett, "The Financing of Electric Power Projects in Developing Countries," *EnergyPolicy*, pp. 326-334, April 1992.

²U.S. Department of Energy, *Foreign Market for U.S. Clean Coal Technologies*, DOE/FE-0317 (Washington, D.C., May 4, 1994).

because U.S. companies are at the forefront of international power development, they can provide many of the products and services used by the industry and can play key roles in the financial markets. Clearly, it is in the interest of the United States — and many other countries — to ensure the sustainable growth of worldwide electric power investment.

OBJECTIVES

This report addresses the ability of financial markets to fund the global expansion of the electric power industry anticipated over the period 1995-2010. The report focuses on the world's developing and transitional countries, where the most investment is expected to be made and where the greatest uncertainty exists as to the adequacy of financing. It answers the question: *Can private financial institutions and markets meet all of the anticipated needs to develop electric power worldwide?* It identifies constraints that may inhibit private financing and suggests actions for mitigating these barriers.

APPROACH

Analysis begins by estimating the extent of financing needed to meet worldwide power demand. This includes projections of the investment capital required in the power sector over the period 1995-2010. Investments include electricity generation, transmission, distribution, and related facilities but exclude electricity utilization or fuel production (e.g., coal mining), which may be associated with expanded electricity production. Capital investment projections are derived from electricity production forecasts published by the International Energy Agency.³ Following these estimates, the report identifies and reviews the sources and techniques used to finance the industry. It then explains the manner in which capital financing takes place in the power industry. Finally, it provides estimates of how much private sector funding will be required in the overall financing mix.

Both public and private entities can raise funds from the private sector — if they can provide investors with acceptable terms, reasonable risks, and an attractive return on investment. Since the sources and types of financing instruments are diverse, and provide many different ways to raise funds, adequate capital will not be available unless enough criteria are met to justify the entire "package" being developed. Determining the adequacy of financing involves answering three fundamental questions:

1. Is enough capital available to meet funding requirements?
2. Can all stakeholder perspectives be reconciled to finance the industry?
3. Can the industry meet the criteria of the private capital sources?

To answer these questions, this report contains an analysis of how international private capital market operations affect capital formation. The purpose of this analysis was to determine the criteria used by private investors to evaluate whether or not to provide capital, and barriers limiting the ability of the electric power sector to raise private funds.

ORGANIZATION OF THIS REPORT

³International Energy Agency, 1995 World Energy Outlook (Paris, France, 1995).

Chapter 2 estimates the magnitude of investments needed worldwide in the period 1995-2010. It covers the electric power industry as a whole, addressing capital needs for all investment purposes.

Chapter 3 describes the various sources of capital available for electric power investment, methods to assemble this capital, and how sources and methods may be matched to needs.

Chapter 4 assesses the operation of capital markets and explains how private capital is raised for electric power in developing countries.

Chapter 5 estimates the private capital required by the industry and describes the perspectives of the key stakeholders. It also points out potential barriers which could prevent capital needs from being met, especially in developing and transitional countries, and suggests options to reduce these barriers.

The **Glossary** defines many of the financial and technical terms used in this report.

Chapter 2

WORLDWIDE INVESTMENT IN THE ELECTRIC POWER INDUSTRY, 1995-2010

This chapter estimates the magnitude of worldwide capital requirements for electric power in the period 1995-2010. Projected investment requirements for power generation, transmission, distribution, and other purposes are then compared to historical and overall investment patterns in each region of the world.

FORECAST APPROACH

Significant capital investment will be required throughout the world to increase electric power generation capacity and to retrofit older coal-fired power plants with environmental control technologies. Capital will also be needed for transmission, distribution and other facilities associated with electric power. The capacity growth estimates presented in this chapter are derived from International Energy Agency (IEA) projections of electric power generation by region.¹ The IEA's regional definitions are used for all projections. These regions are defined in Table 2-1 and are the greatest detail in which consistent global projections are available from this source.

Estimates have been made using a three-step process:

Step 1 Estimate Total Generation Capacity by Type Required in 1995 and 2010. Estimate worldwide generating capacity for each year based on the IEA reference scenario. Unpublished generation capacity figures for the "Capacity Constraints" scenario of the *1995 World Energy Outlook*, published by the IEA are used as the basis for these estimates.² Assume the IEA solid fuel projection is the equivalent of coal for purposes of estimating capital costs. (This classification also includes small amounts of renewables, mostly waste fuels.) Projections of changes in generation and generating capacity supporting the estimates of investment are shown in Table 2-2.

Step 2 Calculate Investments for Power Generation. Derive capital costs per kW for each technology from the Electric Power Research Institute, *Technical Assessment Guide*, EPRI TR-102276-V1R7, June 1993. These costs represent total plant investment minus Allowance for Funds used during Construction (AFUDC), a U.S. regulatory concept. Make adjustments for cost differences among regions. Assume likely distributions of new power generation technologies and retrofit and repowering technologies for a portion of existing coal-fired powerplants, using only current commercial technologies. Retrofit and repowering estimates include investments in clean coal technologies used to reduce emissions and increase the efficiency of coal-fired powerplants. Add an estimate of deferred investments for plants already built.

Table 2-1

¹To make the projections, the International Energy Agency uses its World Energy Model — an elaborate set of assumptions and methodologies on energy prices, structural changes, energy efficiencies, and population and economic growth. Results are published in International Energy Agency, *1995 World Energy Outlook* (Paris, France, 1995), which includes a baseline reference case (the Capacity Constraints Scenario) used for this analysis.

²Personal communications, Maria Argiri, International Energy Agency, Paris, November 11 and 30, 1994 and February 19, 1996.

INTERNATIONAL ENERGY AGENCY REGIONAL DEFINITIONS³

NORTH AMERICA: Canada, United States

WESTERN EUROPE: European Union Countries, Finland, Switzerland, Iceland, Norway, Turkey

OECD PACIFIC RIM: Japan, New Zealand, Australia

CENTRAL AND EASTERN EUROPE: Albania, Bulgaria, Czech Republic, Hungary, Poland, Romania, Slovakia, former Yugoslavia

NEWLY INDEPENDENT STATES: Armenia, Azerbaijan, Belarus, Estonia, Georgia, Kazakhstan, Latvia, Lithuania, Russia, Tajikistan, Turkmenistan, Ukraine, Uzbekistan

CHINA

EAST ASIA: Brunei, Hong Kong, Indonesia, Kampuchea, Laos, Malaysia, Myanmar, North Korea, Papua New Guinea, Philippines, Singapore, Republic of Korea, Taiwan, Thailand, Vietnam, Pacific Islands, Afghanistan, Mongolia

SOUTH ASIA: Pakistan, India, Bangladesh, Nepal, Sri Lanka

AFRICA: All 53 African countries

LATIN AMERICA: All South and Central American countries, and the Caribbean

MIDDLE EAST: Israel, Jordan, Syria, Iraq, Iran, United Arab Emirates, Oman, Yemen, Saudi Arabia, Kuwait, Qatar, Lebanon

³The eleven IEA regions are defined based on geographic location and membership status in the Organization for Economic Cooperation and Development (OECD). They consist of three regions of OECD members ("North America," "Western Europe," and "OECD Pacific Rim") and eight regions of non-OECD members. OECD members are all developed countries and are classified as "developed" countries in this report. Two non-OECD member regions, "Central and Eastern Europe" and the "Newly Independent States" are "transitional" (i.e., former communist) countries. The other six regions are classified as "developing" countries in this report.

The developing country category includes a broad array of countries, ranging from rapidly-industrializing to low-income developing countries. Their financing capabilities vary widely. Meeting the financing requirements of Singapore, Brunei, Taiwan, or Saudi Arabia, for example, is substantially different from meeting needs of lower income countries also classified here as "developing."

Table 2-2
PROJECTED WORLDWIDE CHANGES IN GENERATION AND GENERATING CAPACITY
BY REGION AND ENERGY SOURCE, CUMULATIVE FOR PERIOD 1995 - 2010

Region	Solid Fuel	Oil	Gas	Hydro/ Renewable	Nuclear	Total
<u>Change in Generation (TWh)</u>						
North America	376	3	648	178	(4)	1,201
Latin America	34	53	100	240	10	438
Western Europe	295	(38)	569	99	5	931
China	866	0	7	317	62	1,253
OECD Pacific Rim	246	(36)	212	40	161	623
East Asia	442	(9)	239	22	88	780
South Asia	346	21	92	158	9	626
Central and East Europe	62	26	57	14	3	162
Newly Independent States	9	(16)	234	67	108	402
Middle East	5	13	233	13	0	265
<u>Africa</u>	<u>163</u>	<u>36</u>	<u>159</u>	<u>38</u>	<u>3</u>	<u>399</u>
World Total	2,845	53	2,550	1,188	445	7,081
<u>Change in Capacity (GW)</u>						
North America	26	1	47	19	3	93
Latin America	15	11	37	58	2	121
Western Europe	51	1	132	17	5	200
China	155	0	2	74	10	231
OECD Pacific Rim	28	0	20	6	22	54
East Asia	69	2	66	7	12	143
South Asia	47	1	21	53	3	122
Central and East Europe	8	10	15	5	2	39
Newly Independent States	10	2	53	14	15	80
Middle East	1	3	44	3	0	52
<u>Africa</u>	<u>15</u>	<u>8</u>	<u>26</u>	<u>6</u>	<u>0</u>	<u>55</u>
World Total	426	41	463	261	73	1,190

SOURCES: Generation — 1995 World Energy Outlook, Capacity Constraints Scenario, base case (Paris, France: International Energy Agency (IEA), 1995); Capacity — unpublished IEA data by region and energy source that underpins these published scenarios.

Step 3 Estimate Transmission, Distribution, and Other Investments. Base these estimates on historical data and projections by individual countries. For developed nations, make the estimates using U.S. data for investor-owned utilities.⁴ Apply projected expenditures for transmission, distribution, and other investments — as a percent of total investment for U.S. investor-owned utilities — to establish estimates for the other developed countries. For developing countries, use historical data from the World Bank to calculate ratios of investment for each category (such as power transmission and distribution) over total investment for power generation.⁵ Apply these ratios to the new projections for generation capital investment.

These projections are intended to serve as an indication of the overall magnitude and distribution of investments under "business-as-usual" conditions. They are not precise forecasts of actual investments, but rather provide one possible scenario of capital investment. They are based on just one projection by the IEA and the assumptions that underlie it. Other projections — both higher and lower — could be developed with different assumptions about energy prices, technological advances, and other factors. Two sensitivity analyses are provided later in this chapter.

INVESTMENT FOR POWER GENERATION

The IEA's baseline projections (Capacity Constraints Scenario) call for world electricity demand to grow at an average rate of 2.7 percent per year until 2000, and at 3.0 percent thereafter.⁶ This translates to a need for 1,190 GW of new power capacity over the next 15 years — and a \$1.4 trillion investment. Table 2-3 summarizes projected worldwide power investments through 2010.

Generating capacity is expected to increase more rapidly in developing countries than in the developed nations of the Organization for Economic Cooperation and Development (OECD). Per capita electricity demand in developed countries is projected to grow from 7.8 MWh in 1992 to 10.2 MWh in 2010.⁷ In contrast, demand in developing countries is expected to grow proportionally faster in the same period — from 1.1 MWh to almost 1.7 MWh⁸. This is due to the fact that developing countries will have higher growth rates for population, power consumption, and industrial production than developed countries. As a result, over two-thirds of total investment in the power sector is expected to flow into developing countries.

Table 2-3
CUMULATIVE WORLDWIDE ELECTRIC POWER INVESTMENTS BY REGION, 1995-2010
(Billion 1993 Dollars)

⁴Energy Information Administration, *Statistics of Privately-Owned Electric Utilities*, Annual Report (Class A and B companies), DOE/EIA-0044(81) (Washington, D.C., 1991) and *Financial Statistics of Major U.S. Electric Utilities 1992*, DOE/EIA-0437(92)1 (Washington, D.C., 1992).

⁵Edwin A. Moore and George Smith, *Capital Expenditures for Electric Power in the Developing Countries in the 1990s*, (Washington, D.C.: The World Bank), February 1990.

⁶*1995 World Energy Outlook* (Paris, France, 1995), op. cit.

⁷Derived from *1995 World Energy Outlook*, (Paris, France, International Energy Agency: 1995), Tables A5 and A6.1.

⁸Ibid.

Investment Type	North America	Latin America	Western Europe	China	OECD Pacific Rim	East Asia	South Asia	Central & East Europe	Newly Indep. States	Middle East	Africa	World Total
Generation												
Solid Fuel	94	22	102	222	51	100	71	19	24	2	27	734
Natural Gas	32	23	89	1	14	41	13	10	33	27	16	298
Oil	1	8	1	0	0	1	1	7	2	2	6	29
Nuclear	6	3	8	18	39	21	6	3	26	0	0	129
Hydro/Renew	<u>17</u>	<u>52</u>	<u>15</u>	<u>67</u>	<u>5</u>	<u>6</u>	<u>48</u>	<u>5</u>	<u>13</u>	<u>3</u>	<u>5</u>	<u>235</u>
Subtotal	149	108	215	308	108	169	139	44	98	34	54	1,426
Other Investments												
Transmission	14	42	20	31	10	28	23	3	14	4	12	200
Distribution	54	36	78	84	39	61	60	11	30	10	19	480
General	<u>14</u>	<u>17</u>	<u>20</u>	<u>43</u>	<u>10</u>	<u>17</u>	<u>21</u>	<u>6</u>	<u>14</u>	<u>5</u>	<u>7</u>	<u>173</u>
Subtotal	82	94	118	159	59	105	103	19	58	18	38	854
Total	231	202	333	467	167	275	242	63	156	52	91	2,279
Annual Average	15	13	22	31	11	18	16	4	10	3	6	152

SOURCE: Resource Dynamics Corporation estimates based on 1995 World Energy Outlook, Capacity Constraints Scenario, base case (Paris, France: International Energy Agency, 1995).

Coal continues to be the most widely-used energy source in the world, and half of all investment (\$734 billion for 426 GW) will go to coal-fired plants. Investments in gas-fired capacity are also expected to be large in most parts of the world. Capital investments totaling \$298 billion will be needed to finance 463 GW of new gas-fired power plants. In addition, \$235 billion will be invested in 261 GW of new hydroelectric plants and some renewables. China, Latin America, and South Asia in particular, are expected to increase their hydrocapacity considerably.

Investment by Energy Source

A variety of energy sources will be used worldwide, depending on their local abundance and cost.

Solid Fuels. Coal is expected to continue to be the most widely-used energy source and to receive the largest investment in every region but Latin America. Asia will lead the world in new coal generation. Fifty-one percent of the \$1.4 trillion investment in new power generating capacity is for solid fuel plants. Currently, 34 percent of world power capacity is coal-fired, generating 39 percent of total electricity⁹. Older coal-fired power plants will also be upgraded to improve efficiency and reliability and to reduce emissions, especially in North America, Eastern and Western Europe, the NIS, and China. The worldwide market for retrofits and repowering of existing coal-fired power plants is estimated at \$128 billion over the next 15 years. Some solid fuel capacity in North and Latin America will be in the solid waste category.

Natural Gas. Gas-fired capacity is projected to grow faster than any other type and is increasingly being used for base load generation. Twenty-one percent, or \$298 billion, of the total investment in new capacity will be for

⁹1995 World Energy Outlook (Paris, France, 1995), op. cit.

gas-fired plants. Capacity factors for gas-fired power plants are increasing in most parts of the world and are expected to keep increasing.¹⁰ This reflects anticipated construction and use of combined-cycle combustion turbines. All regions except China, which has only small gas reserves, are expected to add substantial gas-fired capacity. Gas will fire more new capacity than any other fuel in North America, Western Europe, the NIS, Central and East Europe, the Middle East, and Africa. It will fuel over half of new generation capacity in Western Europe, North America, and the NIS — and over 80 percent of new generation capacity in the Middle East. Lower capital costs, shorter lead times, low gas prices, and environmental concerns are stimulating investment in gas-fired generating units.

Hydroelectric Power. The total worldwide investment in new hydroelectric capacity is projected at \$235 billion. Strong growth is projected in China and Latin America, both of which have large, untapped hydroelectric resources. China is expected to increase its hydro capacity by 74 GW, or 32 percent of total new capacity. In Latin America, hydroelectric plants generated nearly 75 percent of all power in 1992. With a planned capacity increase of 58 GW between 1995 and 2010, or 48 percent of total new capacity, it will continue as the most important source in Latin America. In OECD countries, by contrast, hydroelectric power development has already reached most of its potential. Capacity factors for new units are much lower than those of existing installations. The substantial hydroelectric potential in eastern Siberia is expected to develop slowly since this remote area has a low population density.

Nuclear Power. New nuclear power capacity is planned in the OECD Pacific Rim (22 GW), China (10 GW), East Asia (12 GW), South Asia (3 GW), and the NIS (15 GW). This total of 62 GW accounts for 85 percent of planned new capacity worldwide. Nuclear power plants are being constructed primarily in Japan, South Korea, China, and Taiwan. A \$110 billion investment will be required to build the 62 GW of new nuclear capacity in the Pacific Rim, China, East Asia, South Asia, and the NIS. Currently, about 81 percent of nuclear power generation capacity is concentrated in developed countries.¹¹ Developing countries, however, will install most of the nuclear plants over the next 15 years. Substantial investments will also be required to rehabilitate nuclear power plants in transitional countries.

Oil. Very little new investment in oil-fired generating capacity is expected to take place.

Investment in Developing and Transitional Countries

Investments will be made in new and upgraded power generation capacity throughout the world. Most of this increase is expected to take place in developing countries, as shown in Table 2-4, including China, East Asia, and South Asia. These estimates show the general magnitude of the investment in different types of countries. The needs of countries within each classification, however, are diverse.

¹⁰For example, average capacity factors for North America and the OECD Pacific Rim in 2010 are expected to be 0.50 and 0.82, respectively — up from 0.27 and 0.49 in 1995.

¹¹1995 World Energy Outlook (Paris, France, 1995), op. cit.

Table 2-4
CAPITAL NEEDS BY USE AND COUNTRY TYPE
(Billion 1993 Dollars)

Type	Generation	T&D and General	Total
Developed	472	259	731
Developing	812	518	1,329
Transitional	142	77	219
Total	1,426	854	2,279

SOURCE: Table 2-3.

China. China is projected to install more new power generation capacity than any other region, virtually doubling its generating capacity by 2010. China's electricity sector, as well as its entire economy, is heavily dependent on coal. Sixty-seven percent of new capacity will be large coal-fired units, often located at mine mouths. The rest will be primarily hydropower, with some nuclear power plants.

China is expected to make over 20 percent of the world's investment in new power plants during the next 15 years — for a total of \$308 billion (Table 2-3). Foreign investment could be substantial. Over the last 15 years, foreign investment totaling \$14.3 billion for 63 large- and medium-sized plants came mostly from the World Bank and Asian Development Bank.¹² This accounted for approximately 11 percent of total investment in power generation. Future investments will come from private sources, both foreign and domestic, to a much larger extent.

China also has ambitious plans to expand its hydroelectric capacity, which has the potential of 380 GW.¹³ Over the next 15 years, China plans to bring 74 GW of new hydrocapacity on line, including the highly-controversial Three Gorges project. By 2010, hydropower will make up 29 percent of a total 432 GW of electric capacity.

Technical problems and high capital costs pose barriers to further development of Chinese nuclear power. The Daya Bay plant, consisting of two 900 MW units came on line in 1994 but has been closed 13 times in its first year of operation due to serious technical problems. In 1995, work began in Ling'ao, Southern China, on a second nuclear plant with two 1,000 MW generators.

East Asia. A total of \$169 billion is needed for power generation in East Asia between 1995 and 2010 (Table 2-3). Of this, coal-fired capacity is likely to receive \$100 billion. Electricity output in East Asia is growing rapidly, at a rate of 6.0 percent per year. Yet, this is slow compared to the 9.4 percent growth rate of the 1980s. A high degree of electrification has already been attained and economic growth may slow somewhat.¹⁴ Most of the new capacity will be coal-fired (69 GW) and gas-fired (66 GW). The share of oil in power generation is

¹²Jiang Shaojun, Director of the General Office of the Ministry of Electric Power, *Journal of Commerce*, December 13, 1994.

¹³"Special Report: Private Power Development in China," *Private Power Executive*, May/June 1994.

¹⁴Certain areas in East Asia still have low degrees of electrification. In Laos, for example, only 13 percent of households have access to electricity (Asian Development Bank, 1993).

expected to decline from 27 percent in 1992 to 8 percent in 2010. Shares of coal and gas capacity will increase from 29 and 11 percent, respectively, in 1992 to 47 and 22 percent in 2010.

Central and Eastern Europe and the NIS. The economies of the countries in these regions declined during the early 1990s. Most of the countries have older, coal-fired plants with little or no environmental controls. Over the next 15 years, roughly 18 GW of coal- and oil-fired capacity will be decommissioned in Central and Eastern Europe and the NIS. Other coal and nuclear power plants will be upgraded and equipped with environmental and safety controls. The NIS are seeking foreign capital to upgrade the older, coal-fired plants. The need for capital investment in these regions is estimated at \$142 billion, with much of it for retrofits and plant upgrades (Table 2-3).

In the longer term, strong growth is anticipated in both gas-fired capacity (15 GW in Central and Eastern Europe and 53 GW in the NIS) and coal-fired capacity (8 GW in Central and Eastern Europe and 10 GW in the NIS). The NIS is also expected to add 14 GW of hydroelectric capacity.

Across Central and Eastern Europe and the NIS, numerous older reactors still operate. It is estimated that approximately \$26 billion will be devoted to adding new and upgrading older nuclear reactors (Table 2-3). Western companies are actively pursuing opportunities to upgrade the older power plants.

Middle East. Today, oil is used to generate most of the electric power in the Middle East, reflecting its locally higher availability. Many of the countries in this region plan to use available natural gas for power generation and use the oil for exports. Hence, the share of power generated by natural gas in the Middle East is expected to rise from less than 41 percent in 1992 to 67 percent by 2010.

South Asia. South Asia will invest \$139 billion in power generation over the next 15 years (Table 2-3). Today, roughly 56 percent of power capacity in South Asia is coal-fired. Coal is expected to account for 39 percent of 122 GW of new generating capacity — at an investment of \$71 billion. Gas will comprise 17 percent of new power capacity, costing \$13 billion. South Asia is also expected to add 3 GW of nuclear between 1995 and 2010. Also 53 GW of new hydrocapacity will be built at a cost of \$48 billion.

India has about 85 percent of total installed capacity in South Asia.¹⁵ Because of substantial reserves of high-ash coal (35 percent), environmental concerns are a priority in India.¹⁶

Africa. The large electric power sector in Africa is defined by varying degrees of economic development. The market for electric power in Egypt and the Maghreb, for example, is larger than it is in the Sub-Saharan countries. Southern Africa is one of the fastest growing markets on the continent, and the Republic of South Africa is expected to play an important role in regional economic growth. In 1991, South Africa dominated the power industry in Africa, with 60 percent of total generation and 44 percent of installed capacity.¹⁷ Between 1995 and 2010, Africa is expected to build a mix of power generating units — half gas-fired, and the other half a combination of coal, oil, and hydroelectric power.

¹⁵Jamshid Heidarian and Gary Wu, Power Sector Statistics for Developing Countries, 1987-1991, (Washington, D.C.: The World Bank, December 1994).

¹⁶World Energy Council, Survey of Energy Resources, 1995, (London, United Kingdom: 1995).

¹⁷ESKOM, Yearbook 1991 (Johannesburg, South Africa, 1992).

Electric generation in Africa is expected to increase at a rate of 4.8 percent annually, for a total of 55 GW of new capacity over the next 15 years. Gas (26 GW), coal (15 GW), and oil (8 GW) will be added at costs of \$16 billion, \$27 billion, and \$6 billion, respectively (Table 2-3). Africa has considerable untapped hydroelectric potential, with 164 GW in Southern Africa alone.¹⁸ However, only 6 GW of hydrocapacity will be installed on the continent because water levels in the dry season are too low to generate needed capacity.

Latin America. With a total of 628 GW of hydro-electric potential,¹⁹ Latin America is expected to be second only to China in new hydroelectric capacity. Over the next 15 years, this region is projected to install 121 GW of new power capacity. Of this total, hydropower will account for 58 GW, costing \$52 billion. Gas will be 37 GW, at a cost of \$23 billion; coal will be 15 GW, for \$22 billion. Coal costs are lower in Latin America than in Africa because of varying levels of retrofits and repowering of existing plants. Capital needs vary widely with the local situation.²⁰

Investment in Developed Countries

Most developed countries are located in Western Europe, the Pacific Rim, and North America. These countries have mature economies, with already-developed electric power infrastructures, and they have slower growth rates than developing and transitional countries.

Western Europe. This region is expected to invest \$215 billion in power generation over the next 15 years (Table 2-3). It will spend \$89 billion for 132 GW of new gas-fired power plants — more than any other region in the world — and will generate 22 percent of its total power needs using gas in 2010. By contrast, only 6 percent of total power needs were gas-generated in 1991. Much of this new capacity will be combined-cycle used for base load generation. In addition, \$102 billion will be invested in 51 GW of new coal-fired power generation, much of it after the year 2000. Nuclear will add 5 GW and hydropower will add only 17 GW to Western European generating capacity.

OECD Pacific Rim. Electricity demand in this region is projected to grow an average of 2.9 percent per year through 2010. Investment of \$108 billion will build 54 GW of new power capacity (Table 2-3), with the majority of capacity being gas- or coal-fired. The share of oil in total generation is expected to decline from 26 percent in 1992 to 13 percent in 2010.

Hydroelectric capacity in the Pacific Rim is also projected to grow — mostly in New Zealand, where hydropower provided over 70 percent of total generation in 1991. Coal will continue to dominate the power sector in Australia, with a 79 percent share in 1991.²¹ Japan is the only nation in the region that plans to increase its nuclear capacity, almost doubling its share by 2010.

¹⁸African Development Bank, Economic Integration in Southern Africa, Volume 2, 1993.

¹⁹Personal communication, Nelson de Franco, The World Bank, Washington, D.C., April 1994.

²⁰The Instituto de Investigacion Technologica (IIT), Universidad Pontificia Comillas de Madrid, estimates installation costs (without capitalization) for hydroelectric alternatives in Latin America as \$866/KW in Bocura, Costa Rica; \$2,300/KW in Changuinola, Panama; \$1,731/KW in Brito, Nicaragua; and \$1,482/KW in Angostura, Costa Rica.

²¹International Energy Agency, Energy Balances of OECD Countries 1990-1991, (Paris, France: 1993).

North America. North America generates power through a mix of fuels, including coal, natural gas, oil, and nuclear power. Further expansion will be dominated by natural gas and coal. Of the \$149 billion to be invested in power generation over the next 15 years, \$94 billion is slated for solid fuels (Table 2-3).

TRANSMISSION, DISTRIBUTION, AND GENERAL INVESTMENTS

Investments required for power transmission include high-voltage transmission lines and associated substation equipment such as transformers, metering equipment, controls, and protective relaying. Transmission lines deliver electricity from generating stations to substations near end users. Typically, this category includes all transmission lines 69 kV and above.

Distribution investments include cables, poles, low-voltage transformers, meters, and associated equipment to deliver electricity from area substations, where transmission voltage is reduced for end users. End users can be industrial plants, commercial buildings, or individual residences.

General investments include facilities and equipment supporting the addition of electric power generation as well as delivery facilities, vehicles, communications equipment, buildings, and general tools and equipment.

Total capital expenditures for transmission, distribution, and general facilities are expected to be \$854 billion in 1993 U.S. dollars, as shown in Table 2-5.

Transmission investments ranged from a low of 4.8 percent of total investment in Central and Eastern Europe to a high of 21 percent in Latin America, with 10 percent being average for developing countries and 6 percent the average for developed. These investment variations are due to the distances that must be covered by new and existing transmission lines. Also, developed countries have a significant amount of high-voltage transmission infrastructure in place and, in most cases, will only need to add support for existing lines. For example, new transmission lines must be built in Latin America, while the basic electric distribution infrastructure already exists in Europe.

For distribution investments, developed countries are expected to invest slightly more proportionately (23 percent) than developing countries (20 percent). While this difference is not significant, the required distribution investment for developed countries is four times the transmission investment. In developing countries, distribution requires only twice the transmission investment, indicating a greater need to build new transmission infrastructure.

Table 2-5
CAPITAL NEEDS BY INVESTMENT CATEGORY
(Billion 1993 Dollars)

Type	Capital Need	Percent of Total Need
Transmission	200	8.8
Distribution	480	21.1
General	173	7.6
Total	854	37.5

SOURCE: Table 2-3.

SENSITIVITY ANALYSIS

The projections of capital requirements for electric power presented in Table 2-3 are derived from long-term energy supply and demand forecasts made by the IEA. Like all such projections, these are based on assumptions about economic growth and the relationship between economic growth and the demand for energy, including electricity. In specific, they are derived from "base case" assumptions that reflect IEA's "most likely" expectations of economic growth.²² They are also based on assumptions about power generation technologies. In particular, the IEA's projections used for Table 2-3 assume a "business-as-usual" (i.e., most likely given current trends) mix of generation technologies. Such assumptions, however, are made about conditions that are inherently uncertain. The impacts of these uncertainties are quantified through sensitivity analyses.

Impact of Higher Economic Growth

If economic growth were to proceed at a rate higher than expected, how much more capital would be required? The IEA also develops economic growth rates for a "high" growth scenario.²³ Like the IEA base-case scenario, which has an average annual global growth rate of 3.1 percent, the growth rates for this high-growth scenario vary by region. The average increase over the base case is 0.4 percent per year. An estimate is made of the capital requirements for electricity under this high-growth scenario by assuming that the increase in the growth rates for electricity generation and required electric capacity are proportional to the increased rate of economic growth.²⁴

²²The forecast assumptions upon which these are based are specified in the 1995 World Energy Outlook, Table A.2, (Paris, France, International Energy Agency, 1995).

²³Ibid.

²⁴That is, if economic growth is 0.5 percent higher than the base case in a region under the high-growth scenario, electricity demand and capacity are also projected to grow at a rate 0.5 percent higher. As global electricity demand has always outstripped economic growth, particularly in developing countries, incremental economic growth rates can be used as a rough proxy for incremental electric generation growth.

The increase in growth rates and the capital requirements for the high-growth scenario are presented in Table 2-6. They show a total cumulative 1995-2010 capital requirement of \$2.88 trillion dollars, compared to \$2.28 trillion in the base case. Hence, a 26 percent increase in capital requirements result from an average increase in growth rate of only 0.4 percent per year. This large increase results from compounding the growth rate differences year after year for 15 years. This additional growth is higher in developing and transitional countries, which have the greatest potential for economic growth. The mature economies of North America, Western Europe and the OECD Pacific, by contrast, also have less likelihood for higher growth rates and thus have less potential for increased capital needs. Even so, due to the large size of their economies, the potential absolute increase in their capital requirements is quite large.

Table 2-6
CUMULATIVE WORLDWIDE ELECTRIC POWER INVESTMENTS BY REGION,
HIGH GROWTH SCENARIO, 1995-2010
(Billion 1993 Dollars)

Region	Added Annual Growth Rate (Percent)	Cumulative Investment Under High Growth Case	Percent Increase in Cumulative Investment
North America	0.2	274	18.6
Latin America	0.7	252	24.8
Western Europe	0.4	399	19.8
China	0.9	573	22.7
OECD Pacific Rim	0.3	188	12.6
East Asia	1.0	349	26.9
South Asia	1.1	317	31.0
Central and Eastern Europe	1.6	117	85.7
Newly Independent States	0.8	221	41.7
Middle East	0.7	67	28.8
Africa	0.8	122	34.1
World Total	0.4	2,879	26.3

SOURCE: Resource Dynamics Corporation estimates based on 1995 World Energy Outlook, High Growth Scenario, Table A.2 (Paris, France: International Energy Agency, 1995).

Greater Use of Clean Coal Technologies

The largest component of capital requirements for electric power worldwide is coal-fired generating capacity. Over half of the investment for power generation shown in Table 2-3 is for coal-fired units including investments in both new units and upgrades to existing ones. Power may be generated from coal using a number of conventional and advanced technologies. Most coal used for power generation today is burned in conventional

"pulverized coal" generating units. These have boilers in which coal is pulverized into a fine powder before being combusted. In many developing and transitional countries (and, in many instances, in developed countries), such boilers have had few, if any, controls on emissions of pollutants such as particulates, sulfur dioxide, and nitrogen oxides. Such emissions can cause significant environmental and health impacts. Lower efficiency technologies also emit more carbon dioxide, a greenhouse gas. As environmental standards tighten worldwide, capital may be required to finance environmental control technologies for both existing and new coal-fired power plants.

The term "Clean Coal Technologies" or "CCTs" refers to a generation of coal utilization technologies at various stages of development that are cleaner and more efficient than the present generation of conventional coal-using technologies. Several are commercially available today for electric power applications and others will come into commercial use in the near future.²⁵ They may be used for either new power plants or to retrofit existing ones.

New power plants may be built using any of several CCTs, depending upon site-specific circumstances and economics. These include pulverized coal plants with particulate, sulfur oxide and nitrogen oxide controls, atmospheric fluidized bed combustion, pressurized fluidized bed combustion and integrated gasifier combined cycle.

Existing power plants may be retrofit with emission controls for particulates, sulfur oxides and nitrogen oxides or they may be "repowered." Repowering is the replacement of the fuel burning components of an existing power plant with a newer technology. Repowering generally results in a power plant with higher overall efficiency, greater capacity and lower emissions.

The capital requirement projections shown in Table 2-3 assume that current practice and trends in coal technology continue in each region. This anticipates some use of CCTs for new power plants and some repowering and retrofit with clean coal technologies to make existing power plants more efficient, and to reduce emissions.

Clean coal technologies generally cost more than conventional technologies. That is, there is an incremental capital cost for enhanced environmental performance and increased efficiency. To some extent, this results from the relative newness of CCTs compared to the conventional technologies. As CCTs are further developed, experience is gained with them, and more vendors emerge and compete, this incremental cost will most likely decline. Table 2-7 shows the impact on cumulative capital cost by region if CCTs were to achieve a much higher market penetration than anticipated in the base case at current relative costs. Such increased penetration would greatly reduce emissions from coal use. Greater worldwide concern over environmental issues could give rise to such a scenario. This scenario shows a worldwide increase in cumulative capital requirements of \$135 billion, of which \$102 billion is for retrofits and repowering of existing units and \$32 billion is for new units.

²⁵For a detailed discussion of Clean Coal Technologies and their worldwide applications see Foreign Marketing for U.S. Clean Coal Technologies, Report to the United States Congress, DOE/FE-0317 (U.S. Department of Energy (Washington, D.C., May 2, 1994).

Table 2-7
CUMULATIVE WORLDWIDE ELECTRIC POWER INVESTMENTS BY REGION,
CLEAN COAL TECHNOLOGY SCENARIO, 1995-2010
(Billion 1993 Dollars)

Region	Base Case	Change in Investment			Clean Coal Technology Case
		New Plant	Retrofits/ Repower	Total	
North America	231	<1	27	27	258
Latin America	202	1	1	2	204
Western Europe	333	1	14	15	348
China	467	16	18	34	501
OECD Pacific Rim	167	1	4	5	172
East Asia	275	6	5	12	287
South Asia	242	4	7	11	253
Central and Eastern Europe	63	<1	9	10	73
Newly Independent States	156	1	11	12	168
Middle East	52	0	0	0	52
Africa	91	2	6	7	98
World Total	2,279	32	102	135	2,414

SOURCE: Resource Dynamics Corporation estimates based on 1995 World Energy Outlook, Capacity Constraints Scenario base case, assuming greater use of advanced clean coal technologies (Paris, France: International Energy Agency, 1995).

Table 2-8 shows details of how the investment in coal technologies differs between the two cases. Investments in the base case reflect assumptions about the mix of technologies likely to be built in each region from 1995 to 2010. At least some clean coal technologies are used in all regions in the base case and virtually all investments in new plants in developed countries are assumed to use advanced emission controls. The CCT case assumes both more widespread use of CCTs and a more advanced mix of technologies. That is, it includes more use of technologies such as pressurized fluid bed combustion and integrated gasifier combined cycle for new units and more use of repowering for existing units rather than retrofitting of emission controls.

Table 2-8
INVESTMENT IN COAL BY TYPE OF TECHNOLOGY, 1995-2010
(Billion 1993 Dollars)

Case	Region	Type of Coal Technology			
		Conventional	New CCT	Retrofit/ Repowering CCT	Total
Base	North America	0	45	49	94
	Western Europe	0	86	16	102
	OECD Pacific	0	47	4	51
	Newly Independent States	5	9	10	24
	Central and Eastern Europe	4	7	9	19
	China	134	70	18	222
	East Asia	25	70	6	100
	South Asia	32	31	9	71
	Latin America	8	13	1	22
	<u>Other</u>	<u>10</u>	<u>11</u>	<u>7</u>	<u>29</u>
	World Total	218	389	129	734
CCT	North America	0	45	76	121
	Western Europe	0	87	30	117
	OECD Pacific	0	48	8	56
	Newly Independent States	1	14	21	36
	Central and Eastern Europe	1	10	18	29
	China	58	162	36	256
	East Asia	0	101	11	112
	South Asia	18	49	16	83
	Latin America	3	19	2	24
	<u>Other</u>	<u>4</u>	<u>19</u>	<u>13</u>	<u>36</u>
	World Total	85	554	231	870

SOURCES: Resource Dynamics Corporation estimates underlying Table 2-3 and Table 2-7.

The largest potential increment of added capital requirement (\$34 billion) is in China, which has both a large base of existing coal-fired plants which could be retrofitted or repowered and a tremendous growth in electric demand, most of which will be generated by coal. The countries of East Asia and South Asia (mostly India) also have a significant potential for added capital requirements for both new and existing plants. Most of the potential added investment in transitional countries is for retrofits or repowering of old, inefficient or polluting existing power plants. The developed countries will be using CCTs for most new capacity in the base case, so their potential for further capital requirements come from retrofits and repowering. In the U.S., for example, higher capital costs could result if CCTs were the method of choice more often than is currently anticipated for compliance with the post-2000 requirements of the Acid Rain provisions of the 1990 Clean Air Act Amendments.

The currently higher capital cost of CCTs compared to conventional technologies may pose a barrier to the introduction of CCTs in some applications. This is particularly true in countries where capital availability is constrained. High market penetration could only be achieved if a major commitment were made to environmental protection and the continued use of coal worldwide. Even so, the higher capital costs of CCTs would also be offset by lower fuel costs where they increase efficiency or allow a less-expensive coal to be used. In addition, as the technologies mature, the incremental capital cost can be expected to decline.

The rest of this report does not refer to these sensitivity analyses, rather, it uses and makes comparisons with the Base Case.

CONTEXT FOR WORLDWIDE CAPITAL NEEDS

A total projected investment of approximately \$2.3 trillion is needed to finance global electric power sector expansion between 1995 and 2010. This averages out to \$152 billion per year. About 68 percent of this total — \$1.5 trillion — will be needed in developing and transitional countries; the remaining capital will be invested in developed countries. While these are large numbers, two questions are fundamental to understanding their significance:

1. How does anticipated spending on electric power over the next 15 years compare to historical spending?
2. How do the capital needs for electric power expansion compare with: a) overall capital needs (i.e., the investment component of gross domestic product) and b) energy sector capital needs, of which electric power is a part?

Developing and developed countries are addressed separately, since they face different issues.

Developing Countries

Developing countries spend billions of dollars annually on new infrastructure projects. The primary sectors receiving these funds are energy (including electric power), transportation, communications, water supply, sanitation, and irrigation. Infrastructure investment typically represents about 4 percent of national output and 20 percent of total economic development investment.²⁶

Historically, governments have borne the primary responsibility for developing basic infrastructure, with about 90 percent of financial flows being channeled through government agencies. Internal funding sources have included tax revenues and user fees; external sources have been multilateral, bilateral, and private investors.

²⁶The World Bank, *World Bank Development Report 1994* (New York: Oxford University Press, 1994).

Historical Electric Power Investment. No consistent statistical estimates exist of historical capital investments in electric power throughout the world.²⁷ However, a rough estimate of capital expenditures in developing countries can be made by combining several sources. The first source is a measure of multilateral development bank lending that exists for the power sector.²⁸ The World Bank also publishes total official development finance commitments for the energy sector,²⁹ which can be scaled down using multilateral bank electric power to energy lending ratios by year, to derive power sector estimates for bilateral agency loans and official grants. Estimates of private sector finance by year (foreign direct investment, portfolio equity investment, and private loans) can be similarly derived by sharing down The World Bank data for financing in all sectors³⁰ to the power sector only.³¹ Finally, approximations of domestic capital investment, both public and private, can be made as a proportion of the total power sector expenditure.^{32, 33}

These sources indicate that, on average, approximately \$18 billion per year was invested in the power sectors of developing countries between 1985 and 1991. This investment began to grow substantially in 1992, rising to about \$48 billion in 1994. Historical annual estimates by financing source are provided in Chapter 3, in Table 3-2.

Projections show that developing and transitional countries will need to invest an average of \$103 billion annually (in 1993 dollars) for electric power projects over the next 15 years. This represents more than a doubling over 1994 investments and a six-fold increase over the 1985-1991 rate of development. Most of the spending is expected to occur in China, followed by the rest of Asia and Latin America. The plausibility of achieving these investment goals is discussed in Chapter 5.

Comparison to Gross Domestic Investment. One simple way to evaluate the ability of a country or region to raise needed capital is to compare its investment requirements with total historical investment.

²⁷It is especially difficult to estimate government spending on electric power in transitional countries during the era of Communist rule. Planning was conducted by central governments and widespread cross-subsidization took place. Expenditures for power, for example, were often mixed with other expenditures. Many power plants were the centers of a variety of often unrelated industries. Prices were unrelated to actual production costs at a site.

²⁸Nicholas H. Ludlow and Benjamin C. Pappas, Trends in Development Bank Lending 1995, (Washington, D.C.: Development Bank Associates, Inc., 1995).

²⁹The World Bank, World Bank Development Report 1994 op. cit.

³⁰The World Bank, World Debt Tables 1994-95 (Washington, D.C., 1995).

³¹This sharedown was done using estimates of the ratio of multilateral development bank private sector lending and equity investments in electric power to total private sector lending and equity investments, as published in Nicholas H. Ludlow and Benjamin C. Pappas, Trends in Development Bank Lending 1995, (Washington, D.C.: Development Bank Associates, Inc., 1995).

³²The World Bank, "Capital Expenditures for Electric Power in Developing Countries in the 1990s," Energy Series Paper #21, (Washington, D.C., February 1990), shows that historically 68 percent of funding comes from domestic sources.

³³Leonard S. Hyman, "Financing Energy Expansion: 1990-2020," World Energy Council Journal, December 1995, indicates that 72 percent of funding comes from internal sources rather than external financing.

Gross domestic investment (GDI) — defined as private and public sector investment in a country, excluding foreign direct investment — is a measure of total investment in a country.

Table 2-9 shows that the GDI of six developing regions was \$811 billion in 1991. It also illustrates that the average annual capital needs for electric power in developing countries averages 12 percent of 1991 GDI.³⁴ South Asia and Africa, however, will require much higher percentages (27.5 and 20.4, respectively) to be directed toward the electric power sector. Both of these regions face significant economic challenges, which raise questions about their ability to raise the needed capital. On a percentage basis, Eastern Europe and Central Asia require the least amount (6.8 percent) of GDI to be directed toward the power sector. Somewhat more of GDI is required in Latin America (7.1 percent), East Asia (15.0 percent), and the Middle East (8.6 percent), reflecting both more expansive capacity and stronger growth. With their much stronger economies, the countries in these regions are in a better position to raise needed capital for power sector investments.

Table 2-9
1991 GROSS DOMESTIC INVESTMENT (GDI) AND ELECTRIC POWER NEEDS
IN DEVELOPING COUNTRIES
(Billion 1991 Dollars)

Region	1991 GDI	Average Annual Electric Power Capital Needs, 1995-2010	Electric Needs As Percent of GDI
Latin America	178	12.6	7.1
East Asia, China, Pacific	310	46.4	15.0
South Asia	55	15.1	27.5
Eastern Europe and Central Asia	202	13.7	6.8
Middle East	38	3.3	8.6
Africa	28	5.7	20.4
Total	811	96.9	11.9

SOURCES: The World Bank, *Power Sector Statistics for Developing Countries, 1987-1991* (Washington, D.C., December 1994). International Finance Corporation, *Trends in Private Investment in Developing Countries, 1994* (Washington, D.C., February 1994). The World Bank, *World Development Report 1994* (New York: Oxford University Press, 1994). This report, Table 2-3.

Although the situation varies by region and country, projected capital needs are a relatively modest share of historical GDI. With economic growth, they would represent an even smaller share of GDI, as is discussed in Chapter 5.

Trends in Capital Flows. Many developing countries will have to attract substantial amounts of foreign capital for electric power and other investments. Long-term capital flows to developing and transitional countries have risen steadily since 1989, as Table 2-10 illustrates. While official development assistance has declined or

³⁴This is a rough comparison, as average annual needs are not a true reflection of the need in any given year. Moreover, projections are being compared here to historical 1991 investment figures. To some extent, this is an "apples and oranges" comparison. Nonetheless, it does illustrate relative magnitudes. Chapter 5 makes more refined comparisons, once investment estimates are introduced in Chapter 4.

remained stagnant during this period, private capital flows of all types have risen dramatically and reached record levels. In addition, private capital flows nearly tripled from \$63 billion to \$173 billion between 1991 and 1994. Marked increases occurred in private capital raised through bonds, foreign direct investment, and portfolio equity. These are discussed in detail in Chapter 4.

Foreign direct investment — which reflects capital spent to acquire companies or substantial portions of companies — is an important component of capital flows, as it reflects investor confidence in the economy of a country. Global foreign direct investment posted a three-fold increase between 1989 and 1994. It peaked at \$234 billion in 1989 and fell to \$150 billion in 1992.³⁵ During the same period, however, foreign direct investment to developing countries increased from \$26 billion to \$47 billion. Mexico, China, Malaysia, Argentina, and Thailand were the principal recipients of this investment, accounting for \$17 billion of total foreign direct investment to developing countries in 1991.

Table 2-10
CAPITAL FLOWS TO DEVELOPING COUNTRIES
(Billion Nominal Dollars)

Source	1989	1990	1991	1992	1993	1994
Official Development Assistance						
Official Grants	19.2	28.7	32.6	29.9	30.1	30.5
Bilateral Grants	11.6	14.0	14.2	7.7	9.3	10.8
Multilateral Loans	11.8	15.2	15.0	12.7	14.5	13.2
Subtotal	42.6	57.9	61.8	50.3	53.9	54.5
Private Capital Flows						
Private Debt						55.5
Commercial Banks	0.8	0.1	3.9	12.8	(2.2)	
Bonds	5.3	3.4	12.5	12.9	42.1	
Suppliers	1.1	7.3	(2.2)	0	2.0	
Other	5.5	4.2	4.3	15.7	3.8	
Foreign Direct Investment	25.7	26.7	36.8	47.1	66.6	77.9
Portfolio Equity	3.5	3.8	7.6	14.2	46.9	39.5
Subtotal	41.9	45.5	62.9	102.7	159.2	172.9
Total	84.5	103.4	124.7	153.0	213.1	227.4

SOURCE: The World Bank, *World Debt Tables, 1994-95* (Washington, D.C., 1995).

Table 2-11 shows foreign direct investment for selected developing countries in 1991. Although foreign direct investment has increased, it still represents an average of only 4.5 percent of GDI in developing countries. Argentina, Venezuela, and Malaysia have been the most successful at financing total investment with foreign direct investment — at 15.1, 19.2, and 20.5 percent of GDI, respectively.

³⁵Clive Crook, "Third World Finance," *The Economist*, September 25, 1993.

Foreign direct investment in developing countries has continued its upward trend, reaching \$67 billion in 1993 and a projected \$78 billion in 1994. Asia and Latin America attracted most of the investment in 1993.³⁶ China was the largest recipient, with foreign direct investment totaling \$26 billion. Eastern Europe and Africa received the least foreign direct investment, at \$5 billion and \$2 billion, respectively. Implications of these trends in capital flows for the power sector are discussed in Chapter 3. A more detailed discussion of foreign direct investment is provided in Chapter 4.

An overall increase in private capital flows is taking place as developing and transitional countries shift from official development assistance to private capital markets to finance electric power sector expansion. Private sector funding is expected to continue to grow as more projects are successfully completed, experience is gained, and the various participants — government, public, and private lenders in developing countries and their foreign counterparts — grow more comfortable with one another.

Table 2-11
1991 FOREIGN DIRECT INVESTMENT (FDI) IN DEVELOPING COUNTRIES

Developing Country	FDI (Billion 1991 Dollars)	FDI as Percent of GDI
Mexico	4.8	7.4
China	4.4	3.3
Malaysia	3.5	20.5
Argentina	2.4	15.1
Thailand	2.0	5.6
Brazil	1.6	2.0
Indonesia	1.5	3.6
South Korea	1.1	1.0
Venezuela	1.9	19.2
Turkey	0.8	3.9
Total	36.8	4.5

SOURCES: Clive Crook, "Third World Finance," *The Economist*, September 25, 1993. The World Bank, *World Debt Tables 1994-95* (Washington, D.C., 1995).

Developed Countries

As in developing countries, the electric power sector in developed countries consists of publicly- and privately - owned utilities and independent power producers. Unlike developing countries, however, the sector has traditionally had a much wider range of sources of capital to fund needed projects: long-term debt (e.g., loans and bonds) using balance sheet financing, portfolio equity, or project finance. Projections (see Table 2-3) show that \$731 billion will be needed to finance needed power sector expansion in North America, Western Europe, and the OECD Pacific Rim between 1995 and 2010. This represents an annual investment of \$49 billion.

³⁶The World Bank, *Financial Flows and the Developing Countries — A World Bank Quarterly* (Washington, D.C., November 1994).

In developed countries, much of the basic electric power infrastructure is already in place, so massive expansion is not required. A significant share of investment will be used, instead, to upgrade existing systems.

Table 2-12 compares projected average annual power sector expansion needs to 1992 levels of GDI. Viewed this way, only 1.3 percent of total investment is needed by the electric power sector. Thus, the availability of financing is less likely to be a barrier than in developing countries.

Natural gas supply comes from a limited number of areas. In 1993, the largest producers of dry natural gas were Russia (21 quads) and the United States (18 quads) who together accounted for 54 percent of world production.³⁷ World natural gas output increased by 13 percent between 1990 and 1993.³⁸

Table 2-12
1992 GROSS DOMESTIC INVESTMENT (GDI) AND ELECTRIC POWER NEED
IN DEVELOPED COUNTRIES
(Billion 1993 Dollars)

Region	1992 GDI	Average Annual Electric Power Capital Needs, 1995-2010	Electric Need As Percent of GDI
North America	1,057	15	1.5
Western Europe	1,599	22	1.4
OECD Pacific Rim	1,231	11	0.9
Total	3,887	49	1.3

SOURCES: Organization for Economic Cooperation and Development, OECD Statistics on the Member Countries in Figures, 1994 Edition (Paris, France: OECD, June/July 1994). This report, Table 2-3.

World demand for fossil fuels, particularly oil and natural gas, continues to rise. Annual usage in the East Asia-Pacific Rim region is projected to grow by 10 percent — far exceeding growth in the rest of the world, which is estimated at between 1 and 2 percent per year.³⁹ Existing capacity is sufficient to meet current demand; however, analysts foresee the need for further investment in oil and gas to build supply up to higher demand levels. The highest rate of increase in global demand for gas will occur in the East Asia-Pacific Rim region, which has the natural gas resources to meet its future demand, especially in Malaysia, Indonesia and China.⁴⁰ Capital must also be raised to develop the gas fields and needed infrastructure.

An independent projection of global capital spending in the energy industries sponsored by the World Energy Council (WEC) is summarized in Table 2-13. This projection covers all energy industries, not just electric power.

³⁷Ibid., Table 4.1.

³⁸Ibid.

³⁹John Gault, "The Impact of Financial and Related Constraints on Oil Markets," in 1995 EPRI Fuel Supply Seminar, held in Memphis, TN, October 16-18, 1990 (Palo Alto, California: Electric Power Research Institute, 1990).

⁴⁰Energy Information Administration, International Energy Annual 1993, DOE/EIA-0219(93), (Washington, D.C., May 1995), Table 8.1.

For electric power, it covers all investments, as does the present study. It is difficult to compare this independent estimate exactly with those made in this report for several reasons. It covers a 30-year period, beginning earlier and ending later than the 15-year projections in this report; and it is in 1990, not 1993 dollars. Nonetheless, two general points of similarity are helpful:

- Electric power is only one of several energy industries that must be financed. Indeed, the WEC study shows electric power worldwide representing only about one-half of total energy investment needs. The electric power industry will have to compete for funds with these, and with other industries.
- The magnitude of the electric power investment is several trillion dollars. Regardless of the exact amount, that is a significant requirement, especially since so much is in developing and transitional countries.

The WEC estimates for developing and transitional countries appear to be in a range compatible with 30 years of investment at growth rates comparable to the present study. By contrast, the WEC investments for developed (industrialized) countries appear to be substantially higher than the present estimate. The authors of the WEC study, however, do agree that they would expect most of the investment to take place in developing countries.⁴¹ They ascribe levels of investment for developed countries in their study to the underlying WEC projections of global energy trends on which it was based.⁴² As was shown in the sensitivity analysis (pages 2-11 to 2-13), even small increases in assumed growth rates compounded over many years produce significantly higher estimates of capital requirements.

Table 2-13
WEC PROJECTION OF CUMULATIVE CAPITAL SPENDING FOR ENERGY, 1990-2020
(Billion 1990 Dollars)

Region	Electric Utility	Gas Utility	Oil and Gas	Coal	Biomass	Total
Developing	3,000	660	4,500	240	390	8,790
Developed (Industrialized)	4,500	600	1,200	180	90	6,570
Transitional (East)	990	330	900	90	30	2,340
Total	8,490	1,590	6,600	510	510	17,700

SOURCE: "Financing Energy Expansion: 1990-2020," Leonard S. Hyman and Desiree C. O'Neill, World Energy Council Journal, December 1995. Regional categories in parenthesis are those used in this article.

j:\project\3388\15\chap2fin.rep 10:36 am September 28, 1996

⁴¹Personal communication, Leonard Hyman, Fulcrum International, Ltd., March 4, 1996.

⁴²World Energy Council and International Institute for Applied System Analysis, Global Energy Perspectives to 2050 and Beyond, (London: World Energy Council, August 1995).

Chapter 3

EVOLVING SOURCES AND METHODS OF FINANCING

The electric power industry in developed and developing countries is being restructured as part of the broader world economic reconstruction that has followed the end of the Cold War. Although the details vary by country, changes in the electric power sector are proceeding in several related directions:

- From government to private ownership
- From monopoly utilities to a competitive industry
- From jurisdictionally-distinct entities to global players.

These changes are stimulating parallel shifts in the way the electric power industry is financed:

- From official to private sources
- From budget allocation to competition for capital
- From country or regional sources to global capital markets.

As discussed in Chapter 2, financing the electric power industry involves raising capital for a variety of purposes, not just for power generation projects. It brings together various types of organizations, each raising capital for different purposes, and it often employs a mixture of funding sources and financing methods.

The structural changes in the industry are far from final, and accordingly, the process of raising capital for the power sector is also in a state of flux. This may be expected to continue for some time. Chapter 3 describes current financing practices, identifies key trends, and highlights the financing options available to different industry segments. Numerous financial terms are used in this Chapter. Many are defined in the Glossary.

FINANCING THE EVOLVING GLOBAL ELECTRIC POWER INDUSTRY

In developed and developing countries, three basic types of organizations raise capital for the electric power industry: domestic private or quasi-private utility companies, parastatal agencies, and private power project developers. Ownership of private utilities has traditionally been domestic in many countries, but the advent of privatization is changing that. In developing countries, as in developed countries, private and quasi-private companies now must raise debt and equity capital in the global capital markets for their project needs. Parastatal (i.e., quasi-governmental) agencies rely on governmental authority to raise funds through taxes, bond issues, or financing from multilateral and bilateral loans and grants. As government-owned power systems in developing countries become privatized, they are increasingly changing their financing methods to more closely resemble those used in developed countries. At the same time, electric power industries in developed countries are also changing, along with the methods they use for finance.

Electric power development is highly capital intensive — and all of the entities requiring capital compete for it. Competition takes place both within the electric power industry and, importantly, with other infrastructure and industrial projects — including irrigation, agriculture, transportation, telecommunication, water supply, and housing. Generally, the terms and conditions on loans or equity investments — including interest rates, term of investment, amortization schedule, security, and liquidity — ration the available capital. As political and economic situations evolve around the world, some countries will be able to secure more favorable terms for their power sector improvements. Others may not be able to obtain adequate financing to meet their power demand.

Privatization

Privatization of the power sector is taking place in many countries around the world, and it is the key trend affecting the course of industry financing. Although the terms differ, privatization involves transferring responsibility for various electric power functions to private organizations or to quasi-governmental organizations that act like private organizations — or some combination. Different functions may be privatized, ranging from limited private power production to the entire industry. Governments are electing to privatize the power sector for several reasons: as part of overall market reforms, to relieve themselves of the burden of providing electric power, to increase economic efficiency, and to allow the industry to raise capital from new sources. Table 3-1 compares the characteristics of recent privatizations in Argentina, Chile, Spain, and the United Kingdom. Many others are now in process, such as in the state of Victoria, Australia.

Privatization creates opportunities for investors to participate in the industry. Depending on the nature of the privatization, investors may be able to make direct foreign investments, portfolio equity investments, or private loans, which may be offered to publicly-owned utilities as well. Opening up the industry to competition through deregulation may also accompany privatization.

One result of privatization has been a five-fold increase in international independent power projects since early 1992.¹ Taken together, privatization, deregulation, and independent power production add up to more competition — both for funding and end users. Privatized utilities and independent power producers no longer need to rely on government budgeting, funding assistance, or subsidies. Instead, they can seek financing from domestic or foreign direct investment, private commercial loans, and equity investors. Privatization also leads to debt-equity swaps in which former sovereign debt is exchanged for foreign direct investment.

The United Kingdom, which privatized its electric power industry in 1991, provides a good example of how capital for new power development is now raised in open capital markets. In this case, power is generated by one set of private companies, distributed by another group of companies, and transmitted by a collective of distribution companies. Each has its own capital needs but meets them without state assistance. Because the industry is privatized, it has attracted more investors, spurring utility growth.

The ability to raise capital from private sources for electric power in developing countries expands during privatization of the power sector because privatization often improves the economic viability of the utilities and power plants. Private utilities are less likely to subsidize rates or allow power theft and other operating inefficiencies. Investors expect that higher operating efficiencies will make private developments less risky. Host governments believe this as well, and it is one motivating factor behind privatization.

¹Jean-Louis Poirer, 1995 Global Independent Power Forecast, The Tenth Annual Cogeneration and Independent Power Market Conference, April 2-4, 1995.

Table 3-1
RECENTLY-PRIVATIZED ELECTRIC POWER INDUSTRIES

Characteristic	Argentina	Chile	Spain	United Kingdom
Year	1992	1987	1988	1991
Objectives	Attract foreign investment, reduce country debt	Broaden ownership, reduce country debt	Broaden shareholder base of ENDESA	Broaden ownership, increase flexibility
Industry Structure Before Privatization	Integrated state-owned entities	State-owned utilities with two major inter-connected distribution grids	Integrated utilities, state-owned holding company owning 96% of ENDESA	Integrated state-owned Central Electricity Generating Board
Privatization Method	Sold 60% of generation, transmission, and distribution to foreign investors; 10% to employees; 30% to public	Formed ENERSIS; ENERSIS acquired state-owned utilities; ENERSIS sold to private market in equity offering	Sold through international public offering	Sold public shares of National Grid transmission; four power generation companies and 12 distribution companies
Industry Structure After Privatization	Independent generation, transmission, and distribution companies. Significant assets owned by private international entities.	Independent generation, transmission, and distribution companies. ENERSIS continues to privatize more facilities.	Vertically integrated. ENDESA, a private holding company, owns 34% of the generating company and distribution companies.	Three generating companies and 12 distribution companies which jointly own the National Grid
Other Impacts	Better-maintained power generation system	Chile's rates are among the lowest in world	Regulatory system guarantees return on assets	Employment reduced 21,000; rates decreased
Wheeling	Yes	Yes	No	Yes
Transmission Access	Open access	Open access	Open access	Open access
Type of Regulation	Generation unregulated; distribution at set rate per kWh	Generation unregulated; inflation-adjusted return and rate base	Allowed inflation-adjusted return on inflation-adjusted rate base	Generation unregulated; transmission and distribution price caps

SOURCE: Charles A. Trabandt, Merrill Lynch & Co., presentation to International Energy Agency Conference on "Strategic Value of Fossil Fuels" (Houston, TX, May 9, 1995).

Projects offering unregulated returns given manageable risk, which are available in some developing countries, are often more attractive to investors than further investment in developed-country power sectors, which have low growth rates. This factor can influence utility investments in developed countries. The Southern Company

(a U.S. electric utility), for example, has been making equity investments in Latin America and the Caribbean since 1993. Such investment could only be possible in a privatized power sector. In fact, one estimate indicates that over the next five years, private power producers are projected to supply 59 percent of the world's new power needs and parastatals are expected to provide 41 percent.² Overall, privatization is a significant trend in financing the global power industry. With this transfer of responsibility, some entities will need to take financial responsibility for serving customers. The creditworthiness of the industry flows from the economic viability of this entity.

Competition

Traditionally, electric utilities have been seen as natural monopolies that are either operated or highly regulated by the government. Starting in the United States in the late 1970s, new perspectives on competition in the electric power sector emerged. Today, a competitive industry structure is spreading worldwide. While the competitors differ from country to country, competition in generation, and sometimes other functions, now is often seen as a prerequisite to economic efficiency in the industry.

Moves toward democracy in many developing countries are further stimulating competition, while improved political stability is encouraging capital investment. In addition, democratic changes in government are often accompanied by new financial regulations, allowing easier access to capital markets. Today, many countries are moving toward freer markets. With fewer restrictions, including those on currency conversion, more entrepreneurial markets have meant new possibilities for private investment in infrastructure projects.

Internationalization

Until only the last several years, the electric power industry was perhaps the most insular major industry in the world. Power systems operated in isolation and were subject only to the jurisdiction of their home governments. In the United States, for example, the industry was (and largely still is) regulated differently in each state. Capital for power projects essentially was raised in the home country (and to some extent for developing countries through multilateral organizations). Legal restrictions prevented foreign ownership, and utilities in different countries had only limited exchanges of power with each other.

With privatization, that insularity is diminishing rapidly. Many power producers now operate internationally, and as power grids change, electric power is beginning to be traded around the world. Whether in Kansas, Szechuan Province, or Botswana, many of the suppliers are the same.

Capital markets have also become highly international. Many investment firms operate internationally, and because the need for power is so basic, investors throughout the world consider power development a good prospect. This makes power improvements more financially solid than other non-infrastructure investments while offering a reasonable rate of return.

²International Private Power Quarterly, First Quarter 1995.

SOURCES OF CAPITAL

Capital for power generation can come from many sources, both public and private. The sources used depend on specific needs and underlying business conditions, which vary by whether the investment is in a developed or developing country. As noted in Chapter 2, about 68 percent of the projected need for electric power financing is in developing or transitional countries. These countries, however, often have the least capability to raise private capital.

Foreign capital for financing electric power in developing countries comes from two general sources: official (government and multilateral) sources and international private investment. Domestic financing — both public and private — may also be part of power industry development. For any project, capital is usually blended from the following sources:

Official Sources	International Private Investment	Domestic Investment
Multilateral Banks Bilateral Agencies Official Grants	Foreign Direct Investment* Private Loans* Portfolio Investment	Sovereign Finance Domestic Capital Self-Finance Consumer Contributions

*May include supplier credits

Table 3-2 provides an estimate of the sources of capital used for electric power in developing countries over the last 10 years. It also provides a perspective on the relative importance of each source. Two trends stand out. First, overall capital available for financing the power sector has virtually tripled over the last four years. Second, the share coming from private capital market sources has increased dramatically.

Certain developing and transitional countries have adequate credit ratings and sufficiently developed infrastructures and utility policies to allow them to finance some of their power plants without external capital. This is primarily the case in middle-income countries in parts of East Asia and Latin America. These characteristics make these countries prime targets for private foreign investment.

Official Sources

A major source of credit in hard currency for developing and transitional countries has been loans from multilateral banks and loans, loan guarantees, and grants from developed-country governments. These are generally referred to as "official credit." Official credit is preferred by developing countries because: (1) interest rates and payment terms are usually more attractive, and (2) it is frequently required before other lenders will become significantly involved. By 1994, official development assistance for the power sector had risen to approximately \$7 billion.

Multilateral Banks. These banks are international organizations formed by governments to fund development. They are often a lender of last resort, providing aid only if bilateral and private capital are unavailable. Multilateral financial institutions also fulfill a vital catalytic role, far exceeding the value of their direct financing or co-financing support. Once a power sector development is supported by a multilateral bank, it becomes far easier to obtain private funding, even for the uncovered portion of the financing. This is true because the 1990

Brady Plan gives priority of repayments in the event of a default to financing issued by the International Monetary Fund or the World Bank, making it far more likely that a power development involving a multilateral bank will be repaid on a timely basis. Involvement by multilateral banks also decreases the likelihood of a host government adopting utility policies or making changes to legal protection that would be detrimental to the interests of foreign investors.

**Table 3-2 ESTIMATE OF POWER SECTOR FINANCING FOR DEVELOPING COUNTRIES
(Nominal Billion Dollars)**

Finance Source	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Official Multilateral Loans	3.3	4.2	3.6	2.8	4.5	3.7	1.5	2.9	3.7	6.0
Bilateral Loans	0.9	1.2	1.2	1.4	0.3	0.2	0.3	0.3	0.1	0.3
Official Grants	1.2	1.6	1.8	1.9	0.4	0.4	0.6	1.1	0.3	0.7
Private Foreign Direct Investment	0.5	0.4	0.6	0.9	1.1	1.1	1.5	1.7	8.0	9.4
Private Loans	0.5	0.4	0.4	0.5	0.5	0.6	0.8	1.5	5.5	6.7
Portfolio Equity Investment	0.0	0.0	0.0	0.0	0.1	0.2	0.3	0.5	5.7	4.8
Subtotal Foreign	6.3	7.8	7.7	7.5	7.0	6.2	5.0	8.1	23.3	27.9
Domestic Investment	10.3	12.8	12.5	12.1	11.3	10.1	8.2	13.2	15.0	20.0
Total	16.7	20.6	20.1	19.6	18.2	16.3	13.2	21.2	38.3	47.9

SOURCES: Resource Dynamics Corporation estimates based on: (a) The World Bank, World Debt Tables 1994-95 (Washington, D.C. 1995); (b) Nicholas H. Ludlow and Benjamin C. Pappas, Trends in Development Bank Lending 1995 (Washington, D.C., Development Bank Associates, Inc., 1995); (c) The World Bank, World Development Report 1994 (Washington, D.C., 1994); and (d) The World Bank, Energy Series Paper # 21, "Capital Expenditures for Electric Power in Developing Countries in the 1990s" (Washington, D.C., February 1990).

In the global power sector, total multilateral development bank financing essentially kept pace with inflation, rising from \$3.5 billion in 1981 to \$6.0 billion in 1994. It has not kept pace with the growth in demand from the power sector, however. Multilateral banks have recently changed their focus from almost exclusively providing sovereign full recourse finance to providing loans and equity to private parties. This shift leverages the banks' efforts by helping to increase the total amount of private capital available.

The **World Bank Group** includes the International Bank for Reconstruction and Development (IBRD), commonly referred to as the "World Bank," the International Development Association (IDA), the International Finance Corporation (IFC), and the Multilateral Investment Guarantee Agency. The World Bank and IDA provide debt financing to governments of developing and transitional countries or to agencies with government guarantees. In 1993, the World Bank and IDA's combined commitments totaled \$23.7 billion; of this, \$2.6 billion was allocated to the power sector.³ During fiscal year 1995, the World Bank only loaned about \$1.7 billion in the power sector, so growth in demand is not being met.⁴ The IFC targets its assistance to private sector entities and also provides equity capital. The IFC as well as the World Bank attempt to bring in other funding to leverage their assistance.

The World Bank's Expanded Co-financing Operation program provides partial guarantees to help improve the access of eligible World Bank borrowers to private sector funds. The maximum guarantee available through the program is 50 percent of total development cost for public sector projects and 100 percent for private sector projects. While other parts of the World Bank have more funding than the IFC, the mandate of the World Bank — to loan to government entities — is structurally incompatible with the current shift to private financing. In response, the World Bank has recently established a Private Sector Group. In addition, the World Bank has signaled that it favors privatization and will not make long-term loans to some countries until the countries either privatize their state-owned utilities or allow private power developers.

The **European Bank for Reconstruction and Development (EBRD)** is owned by its 53 member nations, the European Economic Community, and the European Investment Bank. The EBRD offers a variety of different types of power industry finance, including loans, equity funding, guarantees, and underwriting through bilateral trust funds, merchant banking, and development banking. The EBRD actively promotes co-financing by seeking to attract public and private capital to Central and Eastern Europe and the Newly Independent States (NIS) of the former Soviet Union.

The **Asian Development Bank (ADB)** is comprised of 52 member nations, 36 of which are from the East Asia-Pacific Rim region, and 16 that are non-regional countries in North America and Western Europe. When giving assistance, the ADB gives priority to the poorest nations in the region and finances power developments through ordinary capital resources and concessional loans.

The **Inter-American Development Bank (IDB)** was created in 1959 to facilitate development in Latin America. The IDB is owned by its 45 member nations, which include regional and non-regional countries. Its stated priority is to assist low-income nations in the region.

The **African Development Bank (AfDB)** was established in 1963 by 23 African nations. By 1995, AfDB membership included 51 independent African states and 24 non-African states. The AfDB's goal is to promote the economic and social development of African member nations through financing of investment projects and programs as well as to mobilize resources through co-financing with bilateral and multilateral development banks.

Bilateral Agencies. Bilateral capital funding often involves government-to-government support for infrastructure projects. While the loans and grants may be from one government to another, in practice they are then lent on to specific power developments. Other bilateral funding may be direct loans to private companies from official export credit agencies.

³The World Bank, World Bank Annual Report 1994 (Washington, D.C., 1994), p. 149.

⁴The World Bank, World Bank Annual Report 1995 (Washington, D.C., September 1995).

Several U.S. government agencies play roles in power industry financing in other countries: the Trade and Development Agency (TDA), Agency for International Development (USAID), Export-Import Bank (Eximbank), and Overseas Private Investment Corporation (OPIC). The governments of other major exporting countries have similar financing programs.

The TDA helps U.S. exporters become involved in the early stages of major capital projects overseas, awarding funds to host nations for feasibility studies performed by U.S. companies. USAID's Energy Project Development Fund is comprised of private and public sector windows and makes funds available to private developers and host governments. USAID also offers feasibility study support to U.S. developers. The Eximbank is an independent agency of the U.S. government whose objective is to aid in financing U.S. exports by assuming risks the private sector is unwilling or unable to accept. It supplements and encourages but does not compete with private sources of capital. The Eximbank also offers guarantees for short-term working capital loans, a comprehensive export credit insurance program, and medium- and long-term loan programs. OPIC assists U.S. companies seeking to make direct investments in foreign countries through loans and loan guarantee programs.

There are other regional development agencies in other regions that support the power sector in developing countries, such as the OPEC fund, the Arab Fund, the Islamic Development Bank, and the Saudi Fund.

Export Credits. Virtually all exporting countries have export credit agencies. Export credits should usually be viewed as supplements to larger financing packages, filling gaps in financing or assuming risks best covered by government agencies. These agencies provide a special form of direct bilateral loan made with a small initiation fee for a specific power industry development. The loan usually bears no interest, is amortized over a long period, and may allow a grace period before repayment, which may be in a lump sum. These favorable terms lower overall debt service for a development. Export credit agency financing is tied to the sale of goods and services from the lending country. In the United States, the major export credit agencies are the Eximbank and OPIC, both of which provide risk insurance for overseas investment projects.

Official Grants. Both multilateral and bilateral agencies provide grants in addition to their loan programs. Since grants are typically for smaller amounts than loans they are not a large source of power sector finance. They accounted for less than \$1 billion in 1994.

Grants are legally-binding commitments which obligate a specific value of funds and require no repayment. In the power sector, they are usually used as seed capital to perform feasibility studies or strengthen capacity to execute power developments. They may be offered in bilateral deals between the governments of the equipment supplier and the host country. Alternatively, they may be offered by multilateral banks and agencies as part of a financing package.

International Private Investment

Three main sources of private international capital are available for electric power development: foreign direct investment, private lending, and portfolio investments. The use of all three financing sources has grown rapidly in the last decade. As countries develop their economies and institutions, they may be able to obtain financing from private sources, leaving multilateral development banks to fund the lower-income developing countries.

Foreign Direct Investment. Foreign direct investment may be used for specific projects, such as power plants, or for entire power systems. It can take the form of equity capital, reinvestment of earnings, or other long- or short-term capital commitments.

Foreign direct investment usually involves some degree of control in operations and management interest in the power development by the investor (usually 10 per cent or more of the voting stock). It may be the financial base for the total capital package, as an equity stake is normally required to secure other financing. Foreign direct investments can be short- or long-term and may involve some reinvestment of profits. This form of private investment is currently the most widely used source of foreign capital in developing and transitional countries. Some countries have permitted Independent Power Producer (IPP) projects, which offer new opportunities for foreign direct investment in the electric power industry. Malaysia, for example, introduced its first IPP licenses in 1993 and had approved a total of five by 1994.

When privatization includes the sale of existing utilities or power plants to the private sector, financing and currency convertibility needs are usually greater than they would be for power plant construction or rehabilitation. Investment funds are typically obtained by the investor from retained earnings or from issuance of stock and bonds in the acquiring company's home markets. Much of this capital may be direct investment by foreign companies. In this situation, access to capital derives from: 1) the credit-worthiness of the foreign company purchasing the newly privatized assets, 2) a reduction of political risk through regulatory reform, and 3) a reduction of financial risk due to gains in operating efficiency, which are the expected result of transferring operating control from the government to the acquiring company.

Increasing foreign direct investment is an important long-term strategy for many of the stronger developing countries. Many countries in recent years have begun to ease financial market restrictions, including currency controls, thereby allowing increased foreign direct investment.

Private Lending. Private financial institutions such as commercial banks lend money to many borrowers in developing countries. The length of the loan varies according to the risk associated with the project, with high-risk projects usually having shorter terms than low-risk projects. The cost of capital is reflected in the interest charged to the borrower. In addition, a risk premium is added to the interest rate, particularly in developing countries. Repayment may take place in set intervals or in a lump sum at the maturity of the loan.

Commercial banks in the United States are decentralized yet regulated by various federal and state agencies. They may be single entities or operate as networks of branches. They often begin operations by obtaining capital from bank stock and other investments and continue by attracting time and demand deposits from individuals and corporations. In turn, they loan about half of this capital to individuals and the other half to commercial customers, industrial customers, and state and local governments. In contrast, most non-U.S. commercial banks are more centralized and regulated by national laws. Many countries have only a few commercial national banks which, therefore, operate with less competition.

In the last 30 years, commercial multinational banks have developed rapidly using subsidiaries, branches, affiliate banks, and representative offices. Each office operates under the laws and regulations of the host country. These banks extend large lines of credit to correspondent foreign banks, which then make loans to specific projects. Loans financing international trade on a short-term basis are also a common service.

A major impetus for the expansion of multinational banking has been the need to follow domestic corporate customers overseas and provide international services to strengthen the customer relationship. The 1973 oil price shocks also made it necessary to clear major oil-trade money imbalances between countries and resulted in a surge of new multinational banks.

During the late 1970s, a huge increase in capital needs for infrastructure developments took place in some developing countries. Commercial multinational banks satisfied part of this demand by making foreign loans, but for regulatory reasons they seldom made equity investments in foreign nonfinancial entities. Even so, the

level of loans from developed-country commercial banks to developing countries reached into the hundreds of billions of dollars during this period.

A variety of negative economic circumstances in developing countries — including high inflation, labor unrest, production difficulties, poor political management, and a drop in foreign exchange revenues — later led to significant default rates on some of these loans. This was particularly a problem in Mexico and Brazil. The default crisis began in 1982 and lasted a decade, in which time commercial banks lost about \$26 billion in Latin America alone. Voluntary medium- and long-term general purpose financing from commercial banks to highly indebted countries all but ended. As a result, developing countries had significant problems financing new power plants through conventional borrowing.

During the late 1980s, many national economies addressed these issues. They made substantial progress in lowering inflation, reducing debt loads, increasing industrial production, and increasing exports. Since 1992, commercial banks have been investing in infrastructure and industrial projects in developing countries again — especially in Latin America. Private sector loans during 1994 rose to over \$6 billion for the power sector.

Portfolio Investment. Globally, some \$20 trillion is under professional investment management today. This pool of funds is growing rapidly and is expected to reach \$53 trillion by the year 2000.⁵ The power sector in developing countries is beginning to tap into this wealth of capital to meet future demand. Portfolio debt offerings in the United States totaled over \$6 billion in publicly-registered and 144A bonds over the last three years.⁶ This is part of a growing trend, with investors accepting more risk, especially in international projects.

Portfolio investments generally involve investment banks putting together debt or equity security issues to finance a project or company. The ability of investment banks to do this depends ultimately on the confidence of investors in both the entity raising capital and the country involved. Capital generally flows to investments with risk and return characteristics attractive to potential investors. Host governments, especially in higher-income developing countries, often have the ability to set policies to alleviate risks and thus attract more capital. Lower-income developing countries also enhance their ability to receive financing from multinational banks by making these changes.

The basic role of investment banks is to put together suppliers and buyers of capital. Investment banks manage the issuance of securities, provide corporate financial advisory and mergers-and-acquisitions services, and engage in brokerage and market-making in debt and equity issues. Working with its client, the investment banking firm prepares the security offering. Each issue is a specialized, customized, and complex process, often involving multiple currencies. The investment bank then goes into one or more financial markets to sell the security. This may be done either through a public offering or as a private placement. Until 1992, insurance companies were the primary investors in power sector developments. Today, buyers providing capital may be individuals, corporations, pension funds, governments, commercial banks, or other institutions.

The investment banking industry is becoming a tightly-knit international network with buyers and sellers from all over the globe. Increased use of information technologies assists in this process by enabling diverse players to access nearly every potential financial market. This has resulted in more competition for capital, irrespective of use.

⁵Jacob J. Worenklein, "Financing Global Infrastructure Through International Capital Markets — A Status Report After the Mexican Peso Devaluation," McGraw Hill Cogeneration and Independent Power Conference (New Orleans, April 4, 1995).

⁶Charles A. Trabandt, presentation to International Energy Agency Conference on "Strategic Value of Fossil Fuels" (Houston, TX, May 9, 1995).

Key firms and major sources of capital for the power industry come from the United States, Great Britain, Japan, Germany, France, Switzerland, and Canada. Investment banks increasingly compete for business in each other's home countries as well as in developing economies. Varying national and firm cultural backgrounds, however, lead to different priorities in placing, originating, and trading practices. In turn, this gives each firm a somewhat different niche when matching the needs of capital borrowers and suppliers.

Power sector portfolio financing has shifted since 1993 from a reliance on insurance companies to participation by a broader spectrum of investors, including mutual funds, professional money managers, pension funds, international banks, and offshore retail investors. In part, this has resulted in the creation of funds specifically targeting the power sector. International and domestic investors have responded positively to reforms enacted by developing countries, and private developers have become active in Asia, Latin America, and the Caribbean. Several funds have been created in recent years for this specific purpose, 11 of which are shown in Table 3-3. Many emerging market funds also partially invest in the power sector.

If the increases in private capital flows to developing countries between 1989 and 1994 and the flourishing of equity funds are signs of more to come, then developing countries may be able to attract considerable investment. However, questions have arisen in the wake of the Mexican peso crisis of early 1995. The collapse of the peso created significant ripple effects throughout Latin America. In Ecuador, for example, interest rates rose to 10 percent *per day* during February 1995.

The Institute of International Finance — which represents 100 of the world's largest commercial banks — predicts that private capital flows to 30 major recipients will decline from \$160 billion in 1994 to \$80 billion in 1995.⁷ Nonetheless, the long-term trend is toward increased use of portfolio investments.

Table 3-3
SELECTED INVESTMENT FUNDS FOR POWER SECTOR DEVELOPMENTS, 1995

- | | |
|-----|--|
| 1. | <i>Scudder Latin America Trust for Independent Power — \$100 million</i> |
| 2. | <i>Latin American Energy and Electricity Fund — \$40 million</i> |
| 3. | <i>Global Power Investments — \$500 million</i> |
| 4. | <i>Asian Infrastructure Fund — \$500 million</i> |
| 5. | <i>AIG-Asian Infrastructure Fund — \$1.9 billion</i> |
| 6. | <i>ABB Funding Partners LP — Amount unknown</i> |
| 7. | <i>The Guandong Development Fund — Amount unknown</i> |
| 8. | <i>AES China Generating Co. Ltd. — Amount unknown</i> |
| 9. | <i>Sithe/China Holdings Ltd. — Amount unknown</i> |
| 10. | <i>Consolidated Electric Power Asia — Amount unknown</i> |
| 11. | <i>Energy Investors Fund — \$275 million</i> |

SOURCE: Dr. Ashfaq Ishag, "Trends and Prospects for Private Power Financing," *Private Power Executive*, January-February 1995.

⁷"Flow of Private Funds to Third World Seen Plunging Following Mexico Crisis," *The Journal of Commerce*, April 21, 1995.

Portfolio investment fund growth also depends, to some extent, on increased use of bond ratings and the creation of investment grade structuring guidelines for power industry improvements in developing countries. Until recently, bond credit ratings for most countries were not prepared by outside credit agencies and insurance company investors made their own assessments. Today, bond ratings are available from third parties, and as rating tools have improved, more investors have entered the market. Credit ratings for developing countries, however, are volatile. Mexico, for example, was rated credit-worthy in November 1994, and by May 1995 many Mexican banks were in potential default. This uncertainty decreases the availability of funds for developing countries.

Portfolio Equity Investment. This category of portfolio investment is often viewed separately, as it has grown more rapidly than debt portfolio investment in developing and transitional countries. Portfolio equity investments place capital in company shares, depository receipts, and investment fund units, with large institutional investors such as pension funds often providing the capital. These investors do not intend to participate in the operation or management of the firm. Portfolio equity investments are made in already-issued stock or stock being issued in an equity market — and such investments can cross borders. However, these investments require access to an equity market, and such markets do not exist in many developing countries. Also, the impact of these investments on available capital is indirect, since capital flows to shareholders through purchases of existing shares. Even so, portfolio investment has played an increasingly important role in developing countries in recent years by adding to total available capital and making markets more liquid.

Supplier and Vendor Credits. In some cases, equipment suppliers may provide capital when participation in the development helps make an equipment sale. Generally, vendors either make a loan or take a short- to medium-term equity stake in the development. They have little incentive to finance the industry long-term.

Domestic Investment

Essential to most power industry development is a large investment by either the host government or the power company itself. On average, about 61 percent of total electric power investment in developing countries has been funded by domestic sources.⁸ Domestic capital markets are a substantial source of investment capital for well-run electric utilities. Developing these markets is a critical priority in many countries.

Sovereign Finance. Sovereign finance is capital supplied by the host government of the country where the power development is located. This is normally the case for projects owned and operated by parastatals, whether they are generation, transmission, or distribution. The host government may raise capital by borrowing or obtaining it from taxes. In many of these cases, because electric rates are subsidized by the government, power company revenues are not adequate to cover annual charges associated with capital investments. In other cases, it may borrow or receive grants from multilateral or bilateral organizations. A special role of sovereign finance occurs when a government guarantees commercial loans. This puts the risk of success on the government yet assures adequate industry finance.

Domestic Capital Markets. Private power companies are generally responsible for raising sufficient capital from private sources. This capital can be raised domestically, if such a market exists, in the form of loans from domestic banks, bonds, or other equity investments. (This is examined in more detail in Chapter 4.) Many developing countries do not yet have full-functioning domestic capital markets. While creating these markets may be a high development priority benefiting the economy as a whole, it is also a complex undertaking that often requires considerable institutional and legal reform.

⁸The World Bank, Energy Series Paper #21, "Capital Expenditures for Electric Power in Developing Countries in the 1990s," (Washington, D.C., February 1990), p. 60.

Domestic capital market development offers several advantages. It provides a large source of capital for the future as well as an incentive to develop and utilize power projects efficiently. Domestic investors tend to keep their returns in the country, unlike foreign investors, who usually want to repatriate their profits. Domestic investors have a greater understanding of local conditions and a stake in the economy. Use of domestic capital also reduces the risk of currency devaluation. Since projects funded in international capital markets often require payment of finance charges in hard currency, having revenues and obligations in local currency reduces the risk of devaluation. In addition, domestic capital is a good source of funding for labor, construction, materials, and supplies, which generally require local currency.

Many developing countries have limited or nonexistent equity markets, as their legal and economic systems have not evolved sufficiently. This makes the process of raising capital difficult, due to limited liquidity and the low quality of issues in the market. Equity markets have only recently been established through the formation of stock markets in some developing countries. These markets tend to grow rapidly, though, and the formal structure of stock exchanges facilitates the process of raising capital. In developing countries with equity markets, the markets are often rudimentary, with a small number of equity issues. They also place restrictions on foreign ownership of stock and limits on repatriation of profits, which act as disincentives for foreign investors.

Domestic portfolio equity investment is a mix of equity issues that may be from different markets or countries. The main prerequisite is an organized market for domestic portfolio investors. Some developing countries — such as Argentina, Chile, Malaysia, and Singapore — have large private and public pension funds.

Self-Finance. Self-finance is reinvestment of internal funds earned through operations. For example, a private utility seeking to finance and build a powerplant would pay for part of it through retained earnings. By contrast, parastatal utilities are not required to pay out any dividends to investors, and may have these earnings from operations to invest. Self-finance is usually an important part of the complete financing package for an electric power project. The World Bank generally seeks self-finance in the range of 25 to 35 percent of the capital cost for the projects that it supports. This range, however, is not an absolute requirement, and individual projects may deviate from this range in either direction, depending on the situation.⁹

The Latin American experience shows the share of self-financing has varied for the electric utility industry. Self-financing averaged 13 percent from 1971 to 1974. Yet, it had declined to a negative 93 percent from 1985 to 1989. The negative 1985-1989 experience resulted from deteriorating financial results due to increasing costs, inadequate pricing, and large debt burdens. Internal funds generated by the operation were not adequate to cover debt service. These numbers reflect the debt crisis in the region of the time.¹⁰ It also reflects a common and continuing problem of many developing countries: tariffs on electricity are so low so that they do not cover costs. In such cases, no funds are available for self-finance, and the government must subsidize the electric power industry. As an example, the electric power industry in India has realized an average rate of return of negative 3 percent over the past decade.¹¹

Consumer Contributions. Consumer contributions to electric power projects are a significant source of financing for the electric power industry, particularly for transmission and distribution systems. Consumer

⁹Personal communication, Jose Maria Bakovic, The World Bank, January 31, 1996.

¹⁰Infrastructure & Energy Division and Latin America Energy Organization (OLADE), The Evolution, Situation, and Prospects of the Electric Power Sector in the Latin American and Caribbean Countries. (Washington, D.C.: The World Bank, August 1991).

¹¹Personal communication, Jennifer Wishart, International Finance Corporation, January 31, 1996.

contributions are funds paid to the electric utility by consumers, third parties, or by earmarked sector taxes . These charges typically pay for the added costs of extending the power system into new areas.

Consumer contributions are common, but vary greatly by country. In Brazil, for example, consumer contributions are required by law and consumers receive no benefit in return other than the electricity. In other countries, by contrast, (Argentina, Chile, Peru, and Bolivia, for example) consumer contributions are required only for grid extensions. The contributors receive stock in the power company in return for their contributions.¹² The ability of consumers to make the contributions varies. Some high-and middle-income developing countries have prosperous consumer bases that can contribute to the financing of electric power expansions. On the other hand, many consumers, especially those in lower income countries, may not have the ability to contribute.

FINANCING METHODS

Four basic methods can be used to finance electric power development, often in combination:

- Government financing
- Equity investment
- Full recourse debt
- Project finance.

Table 3-4 shows the various sources of capital by financing method. The choice of methods depends on whether the capital is to be raised by a government agency or a private entity. The combination of financing sources and methods also depends on economics and risk factors, including political and economic stability.

Table 3-4
METHODS USED TO FINANCE ELECTRIC POWER

Sources of Capital	Financing Methods			
	Host Government	Equity Investment	Full Recourse Debt	Project Finance
Multilateral Banks	✓	✓	✓	✓
Bilateral /Export Credits	✓	✓	✓	✓
Official Grants	✓			
Foreign Direct Investment		✓		
Private Loans			✓	✓
Portfolio Investment	✓	✓	✓	✓

¹²Personal communication, Jose Maria Bakovic, The World Bank, January 31, 1996 .

Sovereign Finance	✓			
Domestic Capital	✓	✓	✓	✓
Self-Finance	✓	✓		
Consumer Contributions	✓	✓		
Supplier/Vendor Credits			✓	✓

Government Financing

The government within a host country often owns and finances its power systems and provides sovereign finance. In such a case, the credit-worthiness of the government determines its ability to raise capital. Host government participation is often critical to a financing package, even when the project is being developed by the private sector. Developers and financial institutions look to the government as the ultimate guarantor of a project.

When the host government develops, owns, and operates the utility, it allocates capital through a political process and raises capital through domestic taxes, bond issues, and sometimes foreign investment. Most governments may be eligible for grants, export credits, and multilateral and bilateral loans. Because capital is rationed politically rather than by economic criteria, considerable inefficiency can arise. This is not always the case, however, since governments differ in their degree of political control over the utility.

Private Financing

Private investors must be able to provide some mixture of equity and debt. Equity investment indicates that the investor is willing to accept ultimate financial responsibility. Debt financing can be obtained using one of two basic techniques: full recourse debt or project finance.

Equity Investment. Equity investment is an important part of most private sector involvement. These investments are made by local investors, foreign direct investors, and portfolio equity investors and managers, including equity funds. (Table 3-1 shows how the power sectors of four countries were privatized through various public offerings.) Such investments may or may not be liquid and publicly tradeable, since some equity investments must be made for the long term. In the event of a default, equity investors sometimes have a higher call on project assets than official development assistance. Investors also may expect to have an active management role in exchange for their financial involvement.

Passive investment in the power sector of developing countries is increasingly taking place through equity funds and public offerings of stock. For example, one Chinese utility raises capital from U.S. capital markets by issuing securities on the New York Stock Exchange. Equity funds operate by collecting money from individuals, corporations, pensions, and other institutions for use in specific program categories. They often purchase bonds, together with some stocks, when investing in the power sector. Table 3-3 lists relevant equity funds.

Full Recourse Debt. Full-recourse debt financing is generally an expeditious and flexible method of raising capital for financially-strong utilities. It is available to international borrowers with excellent credit histories, good economic prospects, and where the host country has adequate currency reserves. Full recourse financing is most often used by a strong entity that builds, owns, and operates the power plant or system. In these cases, no discrete revenue source can be applied to repayment of financing for the project.

In full recourse finance, the lender supplies funds as a general obligation of the borrower, which may be the utility and/or host government. That is, the lender looks solely to the overall operating revenues and assets of the borrower for repayment. In some circumstances, lenders are granted liens on major pieces of equipment or other assets, which they may attach if payments are not made. This is not always a practical solution for the lender, however, because seizing assets could jeopardize future payments.

Full-recourse finance almost always requires a significant equity investment on the balance sheet. For strong borrowers, the debt/equity ratio depends primarily on the cost of capital to the utility. For less credit-worthy borrowers, the lenders may require the equity portion to be a certain percentage — typically ranging from 20 to 30 percent — of total cost to provide a safety margin for the debt.

Potential lenders look at the overall operating and financial history of a borrower to see whether it can afford to service the debt on the new facility. If the borrower is not expected to have sufficient cash flow, the lender looks to the host government for additional financial assurances, which must be willing to provide guarantees of additional payments.

If the country is weak financially or lacks currency reserves, the risk is higher, since specific revenues are not attachable to secure payment and funds may not be available for payment. In fact, at that point the only security is the good faith and credit of the host utility or government, perhaps supplemented by credible liens on assets. For developing and transitional economies, this is usually insufficient to obtain financing, especially where liens are not a realistic alternative.

Project Finance.¹³ Project finance is now being used to build power plants in many countries, including some developing and transitional countries. Project finance involves setting up an independent entity to serve as the builder, owner, and/or operator of the power facility. The intent is to create a revenue-generating project entity that operates profitably under market economy conditions and has no interference from the host country. A portion of the revenue stream from the project is then dedicated to repaying the debt. Project finance can maximize the developer's return on equity while minimizing risk. It may be part of a privatization of the utility industry in a given country. However, because risk distribution dictates the structure of a transaction, project finance provides countries with far less control in a project than transactions using sovereign credit.

In a "pure" project finance transaction, the host country does not bear any of the risks of the power project. Rather, the lenders look solely at the assets and earnings of the borrowing entity for repayment of loans. Most of these transactions in developing and transitional countries are actually considered to be quasi-project finance arrangements because the host country is required by the lenders to assume a limited portion of risk through various undertakings.

Developing the structure and gaining agreement on the requirements of each project is usually the job of an investment banker, who is hired as an advisor by the project manager. The investment banker's goal is to meet

¹³For a more detailed description of project finance techniques used in international power projects, see Department of Energy, Clean Coal Technology Export Finance, DOE/FE-0307 (Washington, D.C., 1994).

the financing requirements while managing outstanding risks and minimizing the need for equity (versus debt) in the project.

Project finance is often a preferred funding method for the power sector. By spreading risks to parties who are willing and able to assume them, and by requiring thorough development and documentation of the transaction, project finance can be less risky to financial institutions (both public and private), utilities, and governments than full recourse debt financing, where the entire risk is assumed by the host country.

To illustrate the complexity of project finance arrangements used today, consider the capital development of an independent power project. Reaching a financial closing can be a long and arduous process involving a large number of investors from many countries. Domestic funding, official development assistance, debt, and equity are often combined in the same financing package. This is done because most power sector projects are very large — often costing hundreds of millions of U.S. dollars — and risk must be divided among parties who are best suited to assume such debt. Sovereign or corporate finance may assume the first level of risk, followed by foreign direct investment and equity investors, then official development assistance, and finally private commercial long-term loans. In this way, each investor shares risk — and each has a stake in the project.

HOW CAPITAL IS RAISED FOR THE ELECTRIC POWER INDUSTRY

The electric power sector of a country may consist of one or more types of organizations, each performing any or all of the fundamental industry functions of generation, transmission, and distribution. Table 3-5 summarizes the characteristics of these functions. Types of electric power organizations include:

- **Fully integrated utilities**, which perform all three functions and generally have the greatest need for capital. Financially stronger private utilities typically use a mix of equity and full recourse debt. Others are state-owned and derive their funding or credit-worthiness from their governments. Costs are covered by revenues from sales to end users and often by government subsidies.
- **Distribution utilities**, which derive revenue from the sale of power to end users. Their financial strength depends on their credibility with these customers.
- **Transmission organizations**, the intermediaries that charge producers and/or consumers for the use of their facilities. Some are new institutions formed by deregulation to facilitate a competitive market. Their financial strength comes from ownership of the transmission grid used by producers and consumers.
- **Power plant owners/operators**, which generally derive economic value from their ability to deliver power profitably under a power sales contract or into a well-defined and stable market. They often use project finance techniques and attempt to minimize their equity participation. This minimizes their risk while maximizing leverage.

Table 3-5
CHARACTERISTICS OF POWER SECTOR FUNCTIONS

Characteristic	Generation	Transmission	Distribution
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Business Purpose	Produce power from various energy sources	Transmit power from generators to load centers	Deliver power to end users
Customer Base (If Stand-alone Operation)	Collect revenue from a limited number of distribution companies	Serve production distribution companies for a fee on power delivered	Buy power competitively from generators; sell to residential, commercial, and industrial customers
Primary Capital Assets	Power plants	Power transmission lines, transmission substations, dispatch centers	Substations, local distribution lines, supporting infrastructure
Typical Project Capital Requirements	\$40 to \$2,000 million	\$50 to \$300 million	\$1 to \$200 million

Each organization must raise capital for its own purpose. The World Bank estimates the ratio of power sector capital needs as being 75 percent power generation and 25 percent transmission and distribution,¹⁴ roughly consistent with the estimates presented in Chapter 2.

The types of electric power organizations in a country determine industry structure, which can vary widely. Since adequate capital must be attracted to finance all industry functions, and because the nature of business varies with each function, different mixtures of financing methods and sources need to be used. Utility regulatory structure and financial strengths of the organization and host country are also factors.

Methods of Raising Capital

The ability of an organization to raise capital depends on its perceived risk and return characteristics. These same parameters also affect the financing method chosen, as shown in Figure 3-1. Generally, riskier projects require more official development assistance as a financing base. Also, fewer financing methods and funding sources are available in riskier projects. As project risks decline, financing packages can incorporate a broad blend of methods, rather than focusing on a single method and source.

Private power companies typically use a mixture of debt and equity. When a utility develops a project using full recourse financing, it first uses its own equity capital. Depending on need, the utility may then secure additional equity funds from foreign direct investment or portfolio investments. Finally, it obtains long-term debt as private and/or multilateral or bilateral loans with repayment responsibilities.

Project finance involves the same process, except that the borrower is typically not a utility but an independent project company set up to build, own, and operate a facility in lieu of the host government. Even so, an initial equity stake must be established before debt can be attracted. A firm power sales contract serves as a source of revenue from which any debt is repaid.

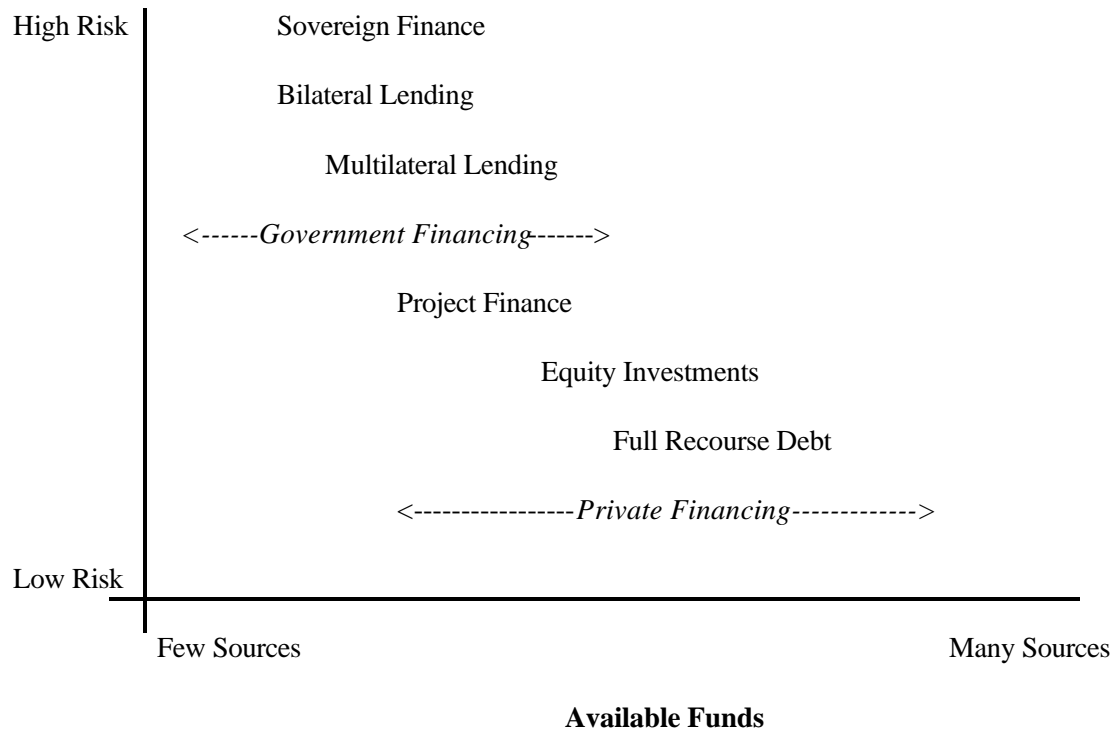
¹⁴Nicholas H. Ludlow and Benjamin C. Pappas, Trends in Development Bank Lending 1995 (Washington, D.C.: Development Bank Associates, Inc., 1995).

Raising Capital in Developed Countries. Normally, sufficient private capital is available for utilities in developed countries, and host governments provide adequate financing for publicly-owned utilities. Risks are acceptable to investors because:

- **The utility sector presents only normal and transparent business risks.** Considerations such as political instability and expropriation are not factors.
- **Needs are well understood.** Developed-country utilities use financially viable models and practices. Because planning is careful and expansion rates are low and relatively less volatile, project risks are smaller.
- **An accepted legal framework for business is in place.** Legal safeguards protect private transactions, including contracts, intellectual property rights, and investor rights. Host governments follow international standards for equitable arbitration between domestic and international parties.

Figure 3-1
Financing Sources and Methods by Project Risk and Fund Availability

Project Risk



- **Electric power industry revenue is adequate.** Rate structures are not subsidized, adequate billing procedures are in place, and power theft is not endemic.
- **Utilities have established credit ratings.** Credit ratings offer more certainty, making investor decisions easier. This helps ensure an adequate flow of capital to the power sector at attractive rates.
- **Domestic capital markets offer much of the necessary financing.** Relatively stable currencies mitigate the risk for externally obtained capital, giving developed countries access to better international loan terms.

Raising Capital in Developing Countries. The financial environment differs in developing countries, where some or all of the above conditions are not met. Mitigating political risks to attract private capital is a difficult and long-term process because of the number and complexity of factors involved. Indeed, capital flight is still a major problem in many developing and transitional countries. A country needs to create conditions that will attract foreign investors and allow the domestic formation of private capital. This may include ending subsidies so that markets can determine prices and allocate supplies. These are often difficult political decisions that transcend the electric power sector.

As the need for capital outstrips available official development assistance, developing countries have sought to expand their financing sources. The main shifts are from government to private financing, and from project finance to investment equity and full recourse debt. However, in the United States the trend has been to move from using full recourse debt to more equity investment and project finance due to higher risks associated with the more competitive utility environment.

As an example of how capital is raised, in 1993 the Chinese central government allocated \$7 billion to power projects. About half of this came from the central government, with additional capital being raised from local governments, domestic bank loans, construction bonds, foreign loans, and supplier loans.¹⁵ More recently, the central government has turned more toward local and foreign private capital.

Criteria for Private Sector Financing

In evaluating which private power sector investments to fund in developing countries, investors typically use the following criteria:

- **A market for the power must exist.** Such a market is necessary to ensure sufficient cash flow. Independent power projects require a power sales contract with a credible utility. Utilities need a viable customer base.
- **Organizational fundamentals must assure profitability and safety of the investment.** The maturity structure of financing must be correctly matched to cash flows of the development, with longer terms entailing greater risks. Interest rate fluctuations must be addressed, and a substantial portion of debt may be funded at fixed interest rates to keep repayment risk acceptable.
- **Credit-worthy host government support or corporate finance must be available.** A credible guarantor must ultimately be financially responsible. In developing countries, the guarantor traditionally has been the government, but with privatization this may no longer be the case. Investors do still look to the government, however. A December 1994 Merrill Lynch survey of 50 insurance companies found that 37 percent would consider investing in foreign projects with no sovereign support while 60 percent would consider investing if sovereign support were available.¹⁶
- **Political risks must be mitigated and government support must be established for private investment and possible privatization.** A conducive political climate minimizes investment risks, such as changes in sovereign government, which would result in repudiation of existing contracts and obligations. These include war, insurrection, or other political instability that could physically damage the development as well as changes in tax policy, royalty, or government-controlled inputs. Government regulation of the utility must be well-defined and transparent so the utility is free from interference or intervention by the host government. This allows market forces to determine appropriate power policies in such areas as pricing and revenue collection.
- **Currency convertibility, repatriation of profits, and mitigation of currency valuation risk must be feasible.** The expectation must exist that reasonably unrestricted conversion of local currency (the basis of the revenue stream) will be allowed at a market exchange rate, and that sufficient foreign

¹⁵"Three Tiered Appraisal System Governs China's Power Sector," *Private Power Executive*, May-June 1994, p. 23.

¹⁶Charles A. Trabandt, op. cit.

reserves will be available to repay loans and repatriate profits into the specified foreign currency over the term of the loans. This may include utilizing a combination of host government guarantees, hedging strategies, and political risk insurance and/or shifting the problem to the host country by denominating debt repayment in dollars.

The better a power company meets these needs, the more likely private investors will be to provide capital. They will also fund less-viable projects guaranteed by multilateral banks or bilateral export finance agencies, which provide loans to projects falling short of private sector underwriting criteria. These banks and agencies also provide assistance to developing and transitional countries to increase financeability. In general, foreign and domestic private capital is provided to the better projects and higher-income countries. Some projects in lower-income countries may not be funded, nor will projects in countries which resist institutional reforms.

Financing Trends

The sources and methods of financing the global power industry have undergone substantial changes in recent years. As a result of these changes, several trends have emerged:

- **Official development assistance and multilateral lending are no longer solely sufficient to meet the needs of developing countries.** Internationalization of commerce has resulted in greater competitive pressures in most industries and contributed to a global recession during the early 1990s. In turn, official development assistance for power improvements cannot keep pace with the growing need.
- **More private capital is going into power development worldwide than ever before while there are fewer public-sector borrowers.** Private capital accounted for 30 percent of total foreign investment in power developments in 1990; in 1994, it had grown to 75 percent. This trend is expected to continue, and the level of private market funding has increased substantially since 1992. Private capital, rather than official development assistance, is now the key seed money for many power sector developments. Private investors have become willing to assume emerging market and development risks in well-structured and fairly-priced offerings. They are also more willing to assume construction risk when the development is properly structured.
- **Bank financing is becoming less important while foreign direct investment and portfolio equity investments are becoming more important sources in financing the industry.** Insurance companies continue to be leading capital providers, yet other investors have become more important since 1993. A short-term downturn in equity investments brought on by the Mexican peso crisis of 1995 will be mitigated as investors scrutinize currency risk more carefully and consider each country's circumstances individually. The long-term trend is toward increased use of portfolio equity investments.
- **A blend of techniques and sources is reflecting the needs of the power industry and a willingness to share risks.** Among the financing techniques that have emerged are international project finance and private investment funds. Developing countries now have more funding sources and methods available to them than they did a few years ago. Because power projects today require a mixture of these sources and methods, utilities are able to develop projects with more economic risk. This will be especially true as the industry evolves from project financing of power generating plants to full recourse financing of the entire industry.

- **As the industry continues to change, financing techniques will also evolve.** Future changes in financing may include:
 - Greater reliance on domestic capital markets,
 - The use of new financing techniques, and
 - Expansion of the base of potential investors.

Private funding sources and financing techniques are changing to meet the needs of the electric power industry and its investors. Given their increasing importance, detailed descriptions of the private capital markets for developing countries are provided in Chapter 4. Questions about the adequacy of these sources and techniques are addressed in Chapter 5.

Chapter 4

GLOBAL CAPITAL MARKETS FOR ELECTRIC POWER

The electric power industry in developing and transitional countries traditionally has been funded by multilateral and public sources. These institutions have not been able to keep pace with the demand for capital, however, and new sources are essential to continued power development. This chapter profiles the structure and function of international and domestic private capital markets in these regions. International markets include foreign direct investment, portfolio equity flows, bonds, and commercial lending. Domestic markets supply both equity and debt.

CAPITAL MARKETS BY REGION

International private investment is on the rise in developing and transitional countries. Even with increased foreign funding, however, domestic capital sources make up the preponderance of private investment in those countries and are key to a country's economic growth.

Table 4-1 provides an overview of private investment in developing and transitional countries. Higher levels of international investments reflect increasing investor confidence in nearly all regions. Some years show negative entries for net flows of capital, but this accounting may hide or understate the size of inflows. Conditions that have attracted international private investment to developing countries are liberalization of capital markets, privatization, and rapid economic growth. In Table 4-1, private debt incorporates bonds, commercial lending, and other private debt.

East Asia is the largest private capital market. The countries in this region have experienced rapid economic growth, fueling demand for capital. In 1990, international capital represented 8.5 percent of total private investment; by 1992, this share had nearly doubled to 16 percent. In 1994, it was close to 27 percent, giving a clear indication of the economic viability of the region.

The second largest market is in Latin America. Recent moves toward privatization and liberalization of capital markets have drawn private capital into many countries in this region. As in East Asia, domestic markets provide the majority of private capital, but the international share of private investment is growing rapidly. In 1989, international capital made up less than 1.5 percent of total private investment in Latin America. By 1991, it had ballooned to 15 percent, and by 1993 it had grown to 26 percent. In 1994, however, international private investment fell to only 17 percent, likely due to fallout from economic problems in Mexico.

In South Asia, private domestic investment declined while international private investment rose rapidly from 1990 to 1994, with a dip in 1992.

For the transitional economies of Eastern Europe and Central Asia, private international investment more than tripled between 1990 and 1992. Problems associated with the transition to a market economy, however, have led to faltering output in many Eastern European countries. Despite this economic decline, international private investment has not fallen substantially, indicating long-term investor confidence.

Table 4-1
PRIVATE INVESTMENT IN DEVELOPING COUNTRIES

(Billion Nominal Dollars)

Region	Source	1987	1988	1989	1990	1991	1992	1993	1994
Latin America	Int'l. Private Debt	1.8	(0.3)	(6.5)	2.5	4.1	7.0	16.7	10.2
	Int'l. Portfolio Equity	0.1	0.2	0.4	1.1	6.2	8.2	25.2	10.5
	Foreign Direct Investment	5.8	8.0	8.2	7.9	12.3	13.6	16.2	18.8
	Subtotal International	7.7	7.6	2.1	11.5	22.6	28.9	58.0	39.5
	Domestic	94.2	115.7	145.4	140.8	124.1	143.4	161.9	194.2
	Total	101.9	123.3	147.5	152.3	146.7	172.3	219.9	233.7
East Asia, China, Pacific	Int'l. Private Debt	(3.6)	1.1	2.8	7.1	10.5	16.8	8.5	22.2
	Int'l. Portfolio Equity	0.4	0.7	2.6	2.3	1.1	5.1	18.1	17.6
	Foreign Direct Investment	4.5	7.6	9.1	11.1	14.0	20.9	36.5	42.7
	Subtotal International	0.9	9.5	14.5	20.5	25.6	42.8	63.1	82.5
	Domestic	122.1	145.7	179.2	219.3	236.5	225.0	212.6	226.1
	Total	123.0	155.2	193.7	239.8	262.1	267.8	275.7	308.6
South Asia	Int'l. Private Debt	3.0	3.3	2.8	2.0	2.5	0.8	2.8	1.9
	Int'l. Portfolio Equity	0.0	0.1	0.2	0.1	0.1	0.3	2.1	7.7
	Foreign Direct Investment	0.4	0.3	0.5	0.5	0.5	0.6	0.8	0.8
	Subtotal International	3.4	3.7	3.5	2.6	3.0	1.8	5.6	10.4
	Domestic	30.2	33.4	37.8	43.0	35.6	36.7	28.4	26.8
	Total	33.6	37.1	41.3	45.6	38.6	38.5	34.0	37.2
Eastern Europe and Central Asia	Int'l. Private Debt	3.9	2.2	5.4	3.8	(2.9)	11.0	8.2	6.6
	Int'l. Portfolio Equity	0.0	0.0	0.0	0.2	0.0	0.1	0.1	0.9
	Foreign Direct Investment	0.1	0.1	0.3	0.4	2.6	4.6	6.7	7.0
	Subtotal International	3.9	2.2	5.6	4.3	(0.3)	15.7	14.9	14.5
	Domestic	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Total	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Middle East and North Africa	Int'l. Private Debt	2.6	4.6	3.2	(2.2)	(0.7)	(0.8)	0.3	3.5
	Int'l. Portfolio Equity	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
	Foreign Direct Investment	1.2	1.9	2.0	1.6	1.2	1.6	1.7	2.1
	Subtotal International	3.8	6.5	5.2	(0.6)	0.5	0.8	2.0	6.0
	Domestic	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Total	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Sub-Saharan Africa	Int'l. Private Debt	0.6	(0.2)	0.8	(1.0)	(1.2)	(1.4)	(2.6)	1.2
	Int'l. Portfolio Equity	0.0	0.0	0.0	0.0	0.0	0.2	0.4	0.8
	Foreign Direct Investment	1.4	1.1	2.5	0.1	1.9	1.8	1.8	2.2
	Subtotal International	2.0	0.9	3.3	(0.9)	0.7	0.5	(0.4)	4.2
	Domestic	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Total	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

SOURCES: Resource Dynamics Corporation estimates based on The World Bank, World Debt Tables 1994-95 (Washington, D.C., 1995) and International Finance Corporation, Trends in Private Investment in Developing Countries 1995 (Washington, D.C., 1995).

The Middle East and North Africa have had low, fluctuating levels of international private investment. In 1988, flows had grown to \$6.5 billion from negative net international investments in 1980. Flows were negative again in 1990, but by 1994 were close to 1988's peak. While this region has seen increasing levels of foreign direct investment, its share of private investment has fallen.

Sub-Saharan Africa has had relatively low levels of international private investment. The relatively small economies of the countries in this region, along with political instability and lack of developed markets, have made the area less attractive to foreign investors. Until 1993, The Republic of South Africa was largely isolated from the rest of the world due to United Nations sanctions.

INTERNATIONAL FUNDING SOURCES

Traditional sources of capital, such as government financing and multilaterals, are losing their dominance in international capital markets. Regulatory reforms, improving macroeconomic conditions, and recent moves toward market economies have encouraged private investment sources. The four main sources of private capital for electric power projects are foreign direct investment, portfolio equity, bonds, and commercial lending.

As mentioned in Chapter 3, project finance has become a popular method of power sector financing. Project finance involves using equity and debt financing, often from both domestic and international sources. The main capital markets involved in this process are described below.

Foreign Direct Investment

Foreign direct investment (FDI) is an equity stake in a foreign enterprise. It is often provided by project developers that build and operate power plants worldwide. Within developing countries, governments or utilities may seek out project developers. At the same time, development firms actively seek out emerging markets where the need for electric power is expected to increase. They assume an equity share in the project and obtain additional financing. Some firms will operate the power plant while others will sell off their interest in the project at a profit, depending upon business strategy. Besides development firms, electric utilities also provide FDI for power projects. Utilities have bought privatized electric utilities and developed new power projects in several developing countries.

Table 4-2 shows that, while the pattern of FDI development varies among regions, FDI is increasing overall. Many developing countries have limited FDI in the past through import substitution programs and foreign currency restrictions, due to concerns about losing control over their resources and being dependent on foreign investors. Some countries have put limits on the amount of domestic currency that can be exchanged into hard currency, and the resulting lack of well-functioning markets has slowed economic growth. On the other hand, Korea and Taiwan have changed their policies and the emerging market systems in these countries are providing opportunities for economic growth. As their economies expand, their need for capital also increases. These countries have now opened their capital markets to foreign investors.

Continued growth in FDI depends, to some extent, on the strength of domestic capital markets in developing countries. A developer or firm investing in foreign equity issues will seek out economies where there is some mechanism to divest their holdings at a profit. A functional domestic equity market provides this mechanism for realizing capital gains.

Table 4-2
NET FOREIGN DIRECT INVESTMENT FLOWS TO DEVELOPING COUNTRIES

(Billion Nominal Dollars)

Region	1987	1988	1989	1990	1991	1992	1993	1994
Latin America and Caribbean	5.8	8.0	8.2	7.9	12.3	13.6	16.2	18.8
East Asia, China, Pacific	4.5	7.6	9.1	11.1	14.0	20.9	36.5	42.7
South Asia	0.4	0.3	0.5	0.5	0.5	0.6	0.8	0.8
Eastern Europe and Central Asia	0.1	0.1	0.3	0.4	2.6	4.6	6.7	7.0
Middle East and North Africa	1.2	1.9	2.0	1.6	1.2	1.6	1.7	2.1
Sub-Saharan Africa	1.4	1.1	2.5	0.1	1.9	1.8	1.8	2.2
Total	14.6	21.2	25.7	26.7	36.8	47.1	66.6	77.9

SOURCE: The World Bank, World Debt Tables 1994-95 (Washington, D.C., 1995) (Note: Total includes Malta, Turkey, and Portugal which are not included in any region.)

When capital markets in developing countries are not established, investment risk is evaluated by comparison to similar FDI in developed countries, where risk and return expectations are based on industry experience. A project in a developing country will usually be associated with less experience and, therefore, will demand a higher rate of return. Risk for foreign investors is influenced by:

- **Government Regulation.** Regulation of utilities determines the potential return on investment. A higher rate of return provides greater viability for a project, reducing risk to the investor.
- **Domestic Policies.** Policies regarding repatriation of profits and taxation levels impact a project's viability. Countries imposing high taxes and limits on transferrable profits are less attractive to investment projects. Also, unstable political conditions create uncertainties in long-term agreements.
- **Currency Convertibility.** The convertibility of foreign currency is important for realizing profits. Restrictions may prevent firms from repatriating their profits. On the other hand, they provide some assurance of economic stability.

FDI Markets. In developing countries, FDI represents the largest source of international private capital, totaling \$78 billion in 1994. As Table 4-2 shows, FDI grew by nearly 30 percent per year between 1987 and 1993. In 1993, foreign investment levels had more than doubled FDI in 1990.¹

Developing countries in Asia received 56 percent of FDI in 1993 and about half of all FDI between 1990 and 1993, with East Asia receiving the majority of investments. The average annual growth rate in FDI was 50 percent per year in the same three-year period. Within the region, China has been the largest FDI market, receiving \$26 billion in 1993 alone. Foreign investors are attracted by China's rapid economic growth, coupled

¹The World Bank, World Debt Tables 1994-95 (Washington, D.C., 1995).

with its vast potential domestic market and low wages relative to other Asian countries. FDI in China rose by 131 percent between 1992 and 1993, after rising 156 percent between 1991 and 1992.²

Latin America was the second largest recipient of FDI, receiving 24 percent of all flows in 1993. The growth rate in FDI for this region was also notable from 1990 to 1993, when net investment grew by 27 percent per year.³ Ongoing improvement of the economic environment in the region — including newly liberalized policies toward FDI and privatization of infrastructure — have contributed to greater flows of capital into these markets. Macroeconomic stabilization has also provided a more viable investment climate, especially given the history of hyperinflation in many Latin American countries. Within the region, Argentina was the largest recipient of FDI, accounting for 39 percent of all inflows to the region and totaling \$6 billion in 1993. In addition, some of the FDI funds flowing into Latin America are repatriated "flight capital." Domestic investors that placed capital abroad during periods of high inflation are now returning capital to their native countries. These investors often have a unique perspective and more information about investment projects than do truly foreign investors.

The three remaining regions have had much lower levels of FDI in recent years. The Middle East and North Africa received \$1.7 billion in 1993, most of which went to the oil exporting countries of North Africa. Transitional economies in Eastern Europe and Central Asia experienced a 44 percent increase from 1992 to 1993. In this region, Hungary is by far the largest target for foreign investors. Sub-Saharan Africa received \$1.8 billion in 1993, with oil-producing Nigeria receiving about half of the region's FDI capital.⁴ The debt crisis of the 1980s still affects several African countries, where economic output has been flat or declining, making them less attractive to investors.

In 1994, FDI represented nearly half of all private international capital. Its importance will likely increase in the future. One estimate suggests growth in developing countries from the \$80 billion level of 1995 to roughly \$400 billion a year by 2020.⁵ If so, developing countries would receive about half of the world's FDI, compared with one-fifth today. The power industry will likely be part of this trend.

Portfolio Equity

International portfolio equity (stock) investments are made when investors from one country have access to equity markets in another country offering stock liquidity. Large institutional investors such as closed-end country funds, insurance companies and pension funds in developed countries have been the largest sources of international portfolio equity investment.

Recently, mutual funds in developed countries have emerged which specialize in developing- and transitional-country equity markets. The rapid growth in available investment funds in the United States, in particular, has created a large flow of portfolio capital to developing and transitional countries. Many of these investment funds exist for the sole purpose of investing in developing countries; some even specialize in electric power projects. (See Table 3-3.) Power projects receiving funds from portfolio equity investors tend to be privatized electric power systems or parts of larger power systems. Individual power plants receive less portfolio equity, due to investor preference for firms with proven track records.

²Ibid.

³Ibid.

⁴Ibid.

⁵The Economist, "Third-World Finance Survey," p. 27, September 25, 1993.

Portfolio Equity Markets. As Table 4-3 shows, the two regions that have benefited the most from portfolio equity flows are East Asia and Latin America, which also dominate FDI. Several developing countries in these regions have liberalized their stock markets, allowing foreign investors to enter their markets and retain at least part ownership of firms. This has opened markets which previously had been closed to foreign portfolio investors.

Table 4-3 also shows portfolio equity flows to developing countries doubling each year from 1990 to 1992 and more than tripling in 1993. These increases are the result of efforts by developing countries to facilitate the flow of funds into their equity markets.

Table 4-3
NET PORTFOLIO EQUITY FLOWS TO DEVELOPING COUNTRIES
(Billion Nominal Dollars)

Region	1987	1988	1989	1990	1991	1992	1993	1994
Latin America and Caribbean	0.1	0.2	0.4	1.1	6.2	8.2	25.2	10.5
East Asia, China, Pacific	0.4	0.7	2.6	2.3	1.1	5.1	18.1	17.6
South Asia	0.0	0.1	0.2	0.1	0.1	0.3	2.1	7.7
Eastern Europe and Central Asia	0.0	0.0	0.0	0.2	0.0	0.1	0.1	0.9
Middle East and North Africa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
Sub-Saharan Africa	0.0	0.0	0.0	0.0	0.0	0.2	0.4	0.8
Total	0.7	1.1	3.5	3.8	7.6	14.2	46.9	39.5

SOURCE: The World Bank, *World Debt Tables 1994-95*, (Washington, D.C., 1995) (Note: Total includes Malta, Turkey, and Portugal which are not included in any region.)

Since many developing countries have undeveloped or nonexistent equity markets, one method of going outside domestic capital markets is to place stock in Global Depository Receipts (GDRs) and American Depository Receipts (ADRs). These Certificates of Deposit enable foreign companies to raise equity in U.S. markets without the need for a listing on a U.S. Stock Exchange or complex settlement and transfer mechanisms. ADRs are issued by a U.S. depository bank with underlying shares held in trust by a custodian bank in the host country. In 1990, Compañía de Teléfonos de Chile raised \$92 million on the New York Stock Exchange through an issue of equity in the form of ADRs. This was the first major equity issue from Latin America in three decades.⁶

Portfolio equity markets in developing countries offer new opportunities for diversification. While many investors view developing countries as too risky, this volatility may ultimately prove to be an advantage, since developing-country markets are not correlated to industrialized equity markets. Calculations by The World Bank

⁶The World Bank, *World Development Report 1994* (New York: Oxford University Press, 1994).

economists show that if U.S. investors had held 20 percent of their portfolios in developing-country stocks between 1987 and 1991, their returns would have been 1 percent higher, with no added risk.⁷

Bonds

Bonds issued by governments, local municipalities, and private or public firms are bought by investors worldwide. Traditionally, insurance firms and pension funds have been large investors in bonds because of the long-term nature of the investment.

Bonds are by far the largest source of cross-border private debt for developing countries. In 1993, bonds accounted for 82 percent of all flows to developing countries. By comparison, commercial loans provided 7 percent and suppliers furnished 4 percent of debt to these regions.⁸

Investment banks are often intermediaries in issuing and underwriting new bonds. After the initial issuance, bonds may be traded freely at several exchanges worldwide. The market is segmented according to risk ratings and bond origin. Government bonds from Organization for Economic Cooperation and Development (OECD) countries are generally viewed as lower-risk than government bonds from developing countries. Private bonds are considered to be higher-risk than government bonds, as the possibility of default tends to be greater, with some exceptions.

Credible bond rating systems are a key feature of bond markets. Most countries, including several developing nations, have domestic rating companies. The principal rating agencies in the United States are Moody's Investor Service and Standard and Poor's. These agencies offer ratings for private and public bonds and provide periodic updates. Many institutional investors have stipulated portfolio allocation guidelines which do not permit investments in securities with ratings lower than investment grade. Bonds rated below investment grade are considered vulnerable to adverse conditions, which could affect their ability to repay interest and principal in a timely manner. Bonds with an investment grade rating are more marketable and can help lower interest rates on future issues.

Unrated bonds provide another source of capital for developing and transitional countries. In the United States, for example, Rule 144A — passed in April 1990 by the Securities and Exchange Commission (SEC) — permits certain large institutions to issue, buy, and resell securities without filing formal registration statements or transaction reports. These bonds may be immediately traded among qualified institutional investors, and after three years may be traded to anyone.

The international bond market is the most widely-used financing instrument for developing countries. Bond issues from these regions have more than doubled every year since 1990.⁹ The three main international bond markets are the "Yankee" market in United States, the "Samurai" market in Japan, and the "Eurobond" market in Europe. The Eurobond market is unregulated, making it more accessible to developing countries, although Rule 144A has made issuing bonds in the United States easier. While businesses or governments may issue bonds in any of these markets, they generally choose the market with the lowest interest rates. For example, when

⁷Clive Crook, "Third World Finance," The Economist, September 23, 1993.

⁸The World Bank, World Debt Tables 1994-95 (Washington, D.C., 1995).

⁹Ibid.

Yankee interest rates increased recently, many Latin American issuers placed their bonds in the Samurai market, where interest rates were lower.

Bond Markets. Overall, bond issues are growing dramatically in developing countries. The majority of bond issues are in dollars, deutsche marks, and yen to reduce currency risk. They account for 95 percent of all issues in developing countries and roughly half of all issues worldwide. As Table 4-4 shows, bond issues more than tripled between 1992 and 1993. Most of this growth took place in Latin American and East Asian countries, due to their larger economies and more progressive policies toward foreign investors. The remaining regions saw very little in terms of bond issues, with the notable exception of Eastern Europe and Central Asia.

Table 4-4
NET INTERNATIONAL BOND ISSUES BY DEVELOPING COUNTRIES
(Billion Nominal Dollars)

Region	1987	1988	1989	1990	1991	1992	1993
Latin America and Caribbean	(2.0)	(1.4)	(0.3)	0.4	3.9	4.6	21.0
East Asia, China, Pacific	0.8	(0.5)	0.1	0.4	3.6	2.9	8.2
South Asia	0.1	0.6	0.7	0.3	1.4	(0.2)	0.5
Eastern Europe and Central Asia	0.6	1.2	2.3	1.8	1.4	0.9	4.8
Middle East and North Africa	0.1	0.3	0.2	(0.2)	(0.1)	(0.2)	(0.7)
Sub-Saharan Africa	(0.1)	(1.0)	(0.3)	(0.9)	(0.5)	0.1	(1.6)
Total	1.1	2.9	5.3	3.4	12.5	12.9	42.1

SOURCE: The World Bank, *World Debt Tables 1994-95* (Washington, D.C., 1995) (Note: Total includes Malta, Turkey, and Portugal which are not included in any region.)

A major factor in the increased flow of capital to developing nations is that these countries have been given higher bond ratings by the rating agencies. Indonesia, Chile, the Czech Republic, and Turkey, for example, have recently been granted investment grade ratings. In 1994, both China's Central Bank and Mexico's Banco Nacional de Comercio Exterior successfully placed \$1 billion bond issues. Private firms in developing countries have also placed large issues in the global bond markets. The average size of bond issues from developing countries was \$150 million, with maturities of less than five years.¹⁰

Commercial Lending

Commercial lending has lost its dominance as the major source of international capital for developing countries. As Table 4-5 shows, flows from commercial banks have varied over time. Commercial lending's current

¹⁰The World Bank, *World Debt Tables 1994-95* (Washington, D.C., 1995), p. 13.

downward trend is due to a recent surge in bond issues from developing and transitional countries. In 1988, commercial loans made up 71 percent of debt flows; by 1993, the share had fallen to 7 percent.¹¹

Table 4-5
NET COMMERCIAL LENDING TO DEVELOPING COUNTRIES
(Billion Nominal Dollars)

Region	1987	1988	1989	1990	1991	1992	1993
Latin America and Caribbean	4.5	4.1	(6.2)	2.2	1.8	4.5	(2.4)
East Asia, China, Pacific	(3.2)	0.7	2.1	4.5	5.1	7.6	(2.1)
South Asia	2.8	2.8	2.3	1.9	1.1	0.7	1.8
Eastern Europe and Central Asia	1.2	1.4	0.7	(5.6)	(5.6)	(0.3)	1.5
Middle East and North Africa	0.9	3.3	0.7	(1.3)	2.2	0.5	(0.7)
Sub-Saharan Africa	(0.7)	(0.3)	(0.1)	0.7	0.8	(1.9)	0.8
Total	5.4	10.5	0.8	0.1	3.9	12.8	(2.2)

SOURCE: The World Bank, *World Debt Tables 1994-95*, (Washington, D.C., 1995) (Note: Total includes Malta, Turkey, and Portugal which are not included in any region.)

Private lending of capital to developing countries is a complex process, often involving several banks and government and multilateral agencies. Loans are structured according to risk levels, and terms are tailored to individual projects and situations, with an average loan length of seven years for developing countries. Investment banks serve as intermediaries between the borrowing party and lenders, creating a total financing package which employs a combination of four main loan categories. The categories, which are differentiated by forms of risk to the lender, are:

- Unsecured Loans — Lender assumes commercial and political risk
- Export-Secured Loans — Mitigate risk through liens on exports or proceeds from exports
- Asset-Based Finance — Reduces risk through liens on a high-value, moveable asset
- Secured Lending — Provides loan collateral through offshore deposit or irrevocable payment.

The complexity of loan financing in developing countries is illustrated by the recent multi-lender financing used in Indonesia's Paton private power project. This non-recourse project finance deal involved five senior debt installments, totalling \$1.82 billion. The installments used interlocking contracts to carry the project's risks and extend the loans long enough to cover construction and early operation of the plant. This arrangement was necessary because conventional loan structures were too short. Commercial banks, export credit agencies, and bilateral lending agencies all participated in the financing.

Supplier credits are a small part of the debt flows in developing countries. These credits are offered by suppliers to facilitate the sale of equipment. In 1993, only \$2 billion of a total \$45.7 billion in debt flows were supplier credits. The net amount of capital from this source has fluctuated between -\$2.2 billion and \$7.3 billion between

¹¹Ibid.

1989 and 1993.¹² These low levels reflect limited availability of funds and lack of long-term interest in projects by suppliers.

Commercial banks, especially in the United States, made large loans to developing countries in the 1970s and early 1980s. During the 1980s, however, the commercial banking industry was reluctant to invest in developing countries due to industry-wide defaults occurring in these regions. Debt service on loans acquired in the 1970s has been a great strain on many developing countries. Several plans have been devised to reduce this debt burden, including debt-for-equity swaps in countries with privatization programs and even trades for preservation of nature in developing countries. Banks have also taken discounts on and forgiven debt. Despite these positive developments, some countries in Latin America and the entire region of Sub-Saharan Africa continue to have difficulty raising capital due to their defaults on previous loans. Renegotiation of debt terms are under way in several countries.

DOMESTIC PRIVATE CAPITAL

Table 4-6 provides an estimate of recent trends in net domestic private investment in developing countries. Domestic private capital accounts for the largest share of total private investment in developing countries.¹³ Domestic private sector borrowing often competes with government investment in state-owned enterprises. As additional privatization efforts occur in many countries, more private domestic capital will be available.¹⁴ Even as international capital markets grew in the late 1980s, the majority of the private capital still came from domestic sources. In recent years, however, the domestic share of investment has declined as international investments have grown.

Several types of debt and equity instruments make up domestic capital markets. Lending markets exist in most developing countries and equity markets operate in some. Lending markets are more basic in structure than equity markets and grow from private lending among individuals and companies. Equity markets are in early stages of development in many countries, although some advanced developing countries have functioning equity markets. Portfolio investment is limited but growing in countries with established equity markets.

Well-functioning markets require private credit rating agencies and public regulatory agencies to ensure adequate flow of information to investors, facilitate monitoring, and provide discipline. The markets also require disclosure of information to the rating and regulatory agencies to assure efficiency of operation.

Due to the diversity of cultures and economic systems among developing and transitional countries, development of capital markets and institutions varies widely. Differing levels of regulation and taxes also influence the structure and operation of capital markets. Turkey, for example, has a tax structure that favors equity issues over bond issues or lending. As a result, many firms have stock listed on exchanges, but in reality the stocks are not traded in the market. This structure acts as a strong incentive to use equity rather than debt financing. India and South Korea and the larger developing countries in Latin America have equity markets that accept domestic investors and also allow foreign investment. Others have only recently established equity markets.

¹²Ibid.

¹³Resource Dynamics Corporation estimates based on The World Bank, World Debt Tables 1994-95 (Washington, D.C., 1995), and International Finance Corporation, Trends in Investment in Developing Countries 1995 (Washington, D.C., 1995).

¹⁴The World Bank, Bureaucrats in Business: The Economics and Politics of Government Ownership (New York: Oxford University Press, 1995).

Table 4-6
NET DOMESTIC PRIVATE INVESTMENT IN
DEVELOPING COUNTRIES
(Billion Nominal Dollars)

Region	1987	1988	1989	1990	1991	1992	1993	1994
Latin America and Caribbean	94.2	115.7	145.4	140.8	124.1	143.4	161.9	194.2
East Asia, China, Pacific	122.1	145.7	179.2	219.3	236.5	225.0	212.6	226.1
South Asia	30.2	33.4	37.8	43.0	35.6	36.7	28.4	26.8

SOURCES: Resource Dynamics Corporation estimates based on The World Bank, World Debt Tables 1994-95 (Washington, D.C., 1995) and International Finance Corporation, Trends in Private Investment in Developing Countries 1995 (Washington, D.C., 1995).

The development of domestic equity markets usually greatly benefits the electric power industry. Infrastructure equity issues in developing countries, such as stock in electric power companies, typically appreciate more in value than other equity issues.¹⁵ These equity issues often provide quality investments that otherwise might not exist in developing countries.

Domestic Lending Markets

The amount of capital available for investment within developing countries is limited due to several factors. First, the economies of these countries are relatively small, and available capital comes from the savings of a country. While most developed nations use their savings for investment, this is not the case in many developing countries. The governments of developing countries often force capital from savings into the public treasury by issuing large amounts of government debt to finance budget deficits. As a result, high savings rates in developing and transitional countries do not necessarily imply high investment levels.

Another reason for lower availability of savings in many developing countries is "capital flight," when individuals try to avoid inflation by sending their capital abroad to more stable economic environments. The threat of currency devaluation also acts as an incentive to move capital abroad.

Domestic lending market operations in developing countries are similar to those in developed countries, but the length of loans is generally shorter. The structure and size of domestic lending markets vary greatly. In countries with Socialist governments where private ownership is restricted, commercial lending may not exist. In other systems of government where private ownership is permitted, commercial lending may have a long tradition. The size of the economy and savings rates among the population also determine the availability of capital for lending. Some developing countries divert savings from individuals into their general funds through mandatory purchases of government bonds, which limits the amount of capital available for private investment.

Malaysia's rapidly expanding energy industry illustrates how domestic lending markets are growing to meet needs for capital. In 1994, Sikap Energy, a local company, contracted with ABB and Bechtel to build a 1,300 M W

¹⁵The World Bank, World Development Report 1994 (New York: Oxford University Press, 1994).

power plant. Sikap Energy financed the entire \$1.5 billion independent power project with domestic capital. Fixed- and floating-rate, 15-year debt financing of \$1.1 billion was arranged by two domestic banks and a local employee pension fund. The remaining \$0.4 billion came from cash flow and shareholder loans.¹⁶

Domestic Portfolio Investment Markets

The main prerequisite for portfolio investment (stocks and bonds) is an organized market. In countries with functioning equity markets, investors without the option of portfolio equity investments tend to obtain bonds, especially government bonds. Investors in developing countries are limited to government bonds, due to lack of private capital markets and legal restrictions on portfolio mix.

Insurance companies and pension funds make a large share of the domestic portfolio investment in developing countries. Some countries with large firms have significant amounts of capital in pension funds. Several East Asian countries have variations of defined benefit systems that act, in part, as a tool of development policy.¹⁷ Because of limited public financing, some developing countries are encouraging domestic portfolio investment in infrastructure and electric power projects. For example, the Philippine Social Security System recently created a \$156 million fund which is administered by local banks for Philippine power projects.¹⁸ Also, Chile has used its pension fund system to promote privatization of public utilities.

As equity and bond markets evolve in developing countries, the opportunities for portfolio investment are increasing. Traditionally, pension funds have been limited to investing in bond markets. Now, some of these investments are being shifted into infrastructure equity investments.¹⁹

Domestic Bond Markets

Domestic bond markets in developing countries are often small, undeveloped, and dominated by government issues. A lack of rating agencies makes placement of private bond issues difficult.

As with equity markets, tax rules can affect the structure of the debt markets. Brazil, for example, taxes bank loans but not corporate bonds. Under this system, firms register their bonds, then sell them to banks with a repurchase agreement to raise capital. Firms also lend their excess bonds to other firms, which in turn sell them discounted to banks. This tends to exaggerate the size of bond markets. Such idiosyncrasies make domestic debt markets in developing countries less uniform in size and structure than markets in developed countries. They also make comparisons between countries difficult, in terms of absolute size as well as ratios of market sizes to aggregate measures such as gross domestic product.

¹⁶Jeannie Mandelker, "Reality Hits Home," *Independent Energy*, March 1995, p. 14.

¹⁷International Monetary Fund, *World Economic Outlook* (Washington, D.C., May 1995).

¹⁸The World Bank, *World Development Report 1994* (New York: Oxford University Press, 1994), p. 107.

¹⁹John L. Anderson, "Expanding Capital Markets," *Independent Energy*, March 1994, p. 8.

Government bonds are typically the first to be issued in a developing economy, followed by private bonds. Bond issues in developing nations are traditionally government or government-related. China made government bond purchases mandatory for municipalities and thereby for the entire population. Government bond issues serve as the benchmark for pricing and maturity structure of the bond markets overall. They also help develop bond markets and provide an indication of the quality of private bond issues.

However, government dominance is expected to soon shift to the private sector. For example, outside China in East Asian bond markets, the 1995 government share was 45 percent of all outstanding bonds, but it is expected to fall to 33 percent by 1999 and 23 percent by 2004.²⁰ This is both because of an increase in the corporate sector of the bond market and the privatization of many state-owned enterprises. Many East Asian governments have recently been encouraging private sector infrastructure investments.²¹

Revenue bonds are new in infrastructure finance in developing countries and use locally-raised money. They are paid back from project revenues only after revenues have been earned. Interest is paid when income is earned, thus differing from traditional bonds. Such bonds have been used to finance the Subic Bay Power Station in the Philippines as well as toll roads in Mexico.

Even though privatization of the electric power sector has increased equity capitalization dramatically, bond markets still may expand in the future. This is due to the fact that many privatized firms had their debt paid off by the government before being sold. Future expansion of the privatized electric utilities will rely to some extent on debt financing.

Domestic Equity Markets

Domestic equity markets vary by country in their size and level of development. Some developing countries have restricted trade to reduce volatility in their equity markets, but this tends to discourage investors seeking liquid investments. Trade restrictions have been put in place to alleviate concerns about economic stability in today's volatile global market. Mexico's recent economic problems represent what many developing countries fear about liberalizing their capital markets.

Domestic equity market development typically follows one of two paths. The first is when a government plans the market based on an existing market in a developed country and gradually adds equity instruments as the market expands. In China, for example, neighboring Hong Kong provided a wealth of information about capital market operation. China opened its stock market in Shanghai in December 1990 and saw it grow rapidly in value and number of issues. Between 1992 and 1994, the value of stocks more than doubled.²² However, Chinese policy-makers have been concerned about the rapid movement of capital in and out of domestic markets. This concern could slow reforms toward a full-functioning domestic capital market.

The second form of equity market development — allowing a market to grow and innovate by itself — has also taken place in China. There, curb markets evolved to become secondary securities markets, where issues are resold after their original sale on the primary market. In China, curb markets operated for years unofficially, and the government condoned this practice by creating secondary markets.

²⁰The Emerging Asian Bond Market, World Bank, Washington, D.C., June 1995.

²¹Ibid.

²²International Monetary Fund, International Capital Markets, Developments, Prospects and Policy Issues (Washington, D.C.: 1994), p. 99.

A large source of capital for equity markets in developing countries is small investors. These investors have been limited to savings accounts in the past and are welcoming the opportunity to diversify their capital. Where permitted, foreign investors may also place large amounts of capital in domestic equity markets.

Privatization has also played an important role in the creation and expansion of equity markets. For privatization to reach a broad audience of investors, a developing country seeks a core investor to manage the entity and then finances the remainder of the project with capital from small- and medium-sized investors. Latin American countries like Chile, Argentina, and Peru have privatized parts of their electric power systems in this way. Argentina then used privatization to expand its equity markets.

Summary of Domestic Capital Markets

Domestic capital markets are a key source of funding for the electric power industry. Investment in domestic markets offers advantages for the host country as well as the power provider, including economic growth and a more stable currency. Table 4-7 provides an overview of the typical characteristics of domestic capital markets in developing countries.

Table 4-7
CHARACTERISTICS OF DOMESTIC CAPITAL MARKETS IN DEVELOPING COUNTRIES

Type of Market	Major Providers of Capital	Market Characteristics
Bond Market	Pension funds, insurance companies, corporations, individuals	Generally underdeveloped; government issues precede private issues
Equity Market	Pension funds, insurance companies, individuals	Develops with privatization; requires stable economy and well-organized market.
Lending Market	Commercial banks, corporations, individuals	Shorter-term than in developed countries; growing in recent years

The next chapter addresses potential barriers to industry financing.

Chapter 5

CAN CAPITAL MARKETS DO THE JOB?

Raising private capital for the electric power industry is a complex undertaking involving many parties and different capital markets. This process will be made more difficult over the next 15 years because most private capital investment will be needed in developing and transitional countries, which have little experience with this type of financing. Raising capital in most developed countries with economically viable industries and well-established financial institutions is not an issue.

This chapter compares the private capital needs of electric power to the total private capital available, describes the perspectives of the parties involved in financing the industry, identifies potential barriers to private financing, and discusses strategies to mitigate these barriers.

POWER SECTOR NEEDS FOR PRIVATE SECTOR FINANCING

As noted in earlier chapters, official development assistance will become increasingly inadequate to meet the financing needs of many developing countries. Private investment will be required to make up the difference.

Table 5-1 compares total projected cumulative private investments to the cumulative funding needed for electric power development in developing and transitional countries between 1995 and 2010.¹ These projections assume current levels of official finance will continue, as increases are considered unlikely. The amount of private capital needed for electric power is simply what the official sources cannot provide, about 80 percent of the total. The situation varies regionally, however, with the private sector providing only 38 percent in Africa, 60 percent in Latin America, and 85 percent in the Middle East.

The total cumulative private investment in each region between 1995 and 2010 is estimated by applying the International Energy Agency's expected economic growth rates, as published in the World Energy Outlook, to the data from Table 4-1. The last column shows the share of private investment required for electric power in each region. Since the numerator of the percent of total private investment includes some developed countries in East Asia, the Middle East, and Africa, the resulting percentages somewhat overstate the power sector's need for private capital in these regions.

As a basis for comparison, Table 5-2 shows the total projected private investments needed for electric power in developed countries between 1995 and 2010. The power sector's share of total expected private investment is much lower than in developing and transitional countries, averaging 1.1 percent. Again, economic growth is considered when forecasting total investment over the 15 years.

¹As noted in Table 2-1, some developed countries are aggregated within these six International Energy Agency regional definitions.

Table 5-1
PROJECTED CUMULATIVE PRIVATE SECTOR INVESTMENT IN ELECTRIC POWER
FOR DEVELOPING AND TRANSITIONAL COUNTRIES BY REGION, 1995-2010
(Billion 1993 Dollars)

Region	Electric Power Investment			Total Private Investment	Electric Power Percent of Private Investment
	Total	Official	Private		
Latin America	202	80	122	4,800	2.5
East Asia, China, Pacific	742	99	643	7,600	8.4
South Asia	242	25	217	800	25.8
Eastern Europe and Central Asia	219	47	172	1,500	11.3
Middle East	52	8	44	600	6.9
Africa	91	56	35	800	4.3
Total	1,548	315	1,233	16,200	7.6

SOURCES: Table 2-3. Resource Dynamics Corporation estimates based on data in this report's Tables 3-2, 4-1, and International Energy Agency, 1995 World Energy Outlook (Paris, France, 1995).

Table 5-2
PROJECTED CUMULATIVE PRIVATE SECTOR INVESTMENT IN ELECTRIC POWER
FOR DEVELOPED COUNTRIES BY REGION, 1995-2010
(Billion 1993 Dollars)

Region	Total Electric Power Investment	Total Private Investment	Electric Power Percent of Private Investment
North America	231	19,300	1.2
Western Europe	333	24,200	1.4
OECD Pacific	167	22,000	0.8
Total	731	65,000	1.1

SOURCES: Table 2-3. Resource Dynamics Corporation estimates based on OECD, Historical Statistics, OECD, (Paris, France, 1995), and OECD, "Aging Populations, Pension Systems and Government Budgets-How Do They Affect Saving," Future Global Capital Shortages, (Paris, France, 1995).

Table 5-1 indicates that 7.6 percent of all private investment in developing and transitional countries between 1995 and 2010 will be in the power sector. In the period between 1987 and 1994, private investment for electric

power was only 1.2 percent of total private investment.² By 1994, this percentage had already risen to 3.5 percent for reasons noted in Chapter 3. Hence, the share of private investment in the power sector needs to double from current levels.

Investment in electric power as a percent of total private investment varies regionally. It is lower in Latin America, Africa, and the Middle East and is higher in East Asia, South Asia, and the transitional countries. In part, this is due to the relatively higher level of investment expected from official development sources and domestic governments in Latin America, Africa, and the Middle East. These differences also reflect variations in necessary infrastructure investments.

Capital for electric power the largest share of expected total private investment in South Asia. This largely reflects the low historical levels of private investment in the region, which averaged only \$39 billion per year over the 1987-1994 period. This region needs to greatly expand the overall level of private investment at a rate greater than the conservative one projected in this report. Recent reforms in the region are now beginning to do that. This overall lack of private investment is also the reason why electric power investments are also projected to be a high portion of total private investment in "Eastern Europe and Central Asia" (the transitional countries).

PERSPECTIVES ON ELECTRIC POWER FINANCING

Obtaining private financing consists of agreeing upon and implementing a set of transactions that meet the needs of all parties involved: those raising capital, those providing it, and various third parties and market intermediaries. Which parties are involved in financing electric power depends upon the structure of the power industry in the country and the nature and magnitude of financing required. At its simplest, a government borrows private funds — typically through a bond issue based on the credit-worthiness of the government itself — and the funds are allocated to a government-owned utility. At its most complex, private financing involves a diverse array of parties, including utilities, government regulatory agencies, multilateral organizations, independent power producers, financial institutions, and various types of investors.

The most fundamental need is to provide investors with the return they want at an acceptable level of risk. In the simple method described above, a financially-credible government either repays the loan directly or provides sovereign guarantees for a parastatal utility. Until recently, this arrangement — sometimes further backed by bilateral or multilateral guarantees — was the most common way to obtain private financing for electric power in the more advanced developing countries. Another option emerged in the early 1990s — private investment using project finance techniques for individual power projects. This option assures financial viability through a power sales contract with the utility, preferably backed by a sovereign guarantee.

Governments in many countries are becoming increasingly reluctant, however, to provide such financing. Power sector needs simply outstrip their financing capacity, and they have other pressing uses for the funds they do raise. Moreover, project financing can apply only to specific projects — not to the industry as a whole — and some financially credible entity must take ultimate responsibility for serving the end users. Project finance also involves extremely complex and difficult transactions. These considerations have led to the privatization of the electric power sector in some countries.

The creation of private electric utilities (or parastatals operated like private utilities) may enhance a country's ability to privately finance its electric utility industry by creating a basis for financing other than the credit of the government. However, it also makes financing more complex. Electric power sector entities must meet all of

²This percentage is calculated from data in Tables 3-2 and 4-1.

the requirements set by government regulators as well as the financial community. These requirements may differ and they sometimes conflict. As a business, the private utility's fundamental requirement to obtaining financing is a viable revenue stream to cover costs, thereby earning investors an attractive rate of return. Investors look to the credibility of the customer base to produce revenues and to the ability of management to control costs.

Obtaining private financing involves matching the needs of governments, power sector entities, and investors, each of which wants something different from the others. These include:

Governments

- **Government Policy-Making Agencies** typically balance multiple concerns — including economic growth, the environment, and sovereignty — in a highly political environment.
- **Regulators** typically retain a significant role in a privatized industry in the areas of economic and environmental regulations. Regulatory frameworks for both may vary.

Power Sector Entities

- **Power utilities** are in the business of reliably delivering power to customers and, if privatized, earning a return for their owners. Depending on industry structure, they may perform different functions. They typically want to be able to raise adequate capital at an affordable cost.
- **Private project developers** usually want to earn a rapid return on investment. They may vary in their attitudes toward actual long-term project operation.

Private Investors

- **Equity investors** generally want a high rate of return, typically greatly exceeding multi-lateral and bilateral aid costs, and are willing to bear some risk of loss of capital.
- **Debt investors** want to preserve principal and earn interest commensurate with risk, also at rates higher than traditionally required.

To finance the electric power industry, these varying perspectives must be matched. The power sector is more than just an assemblage of independent generation projects. It must perform and coordinate a series of functions — generation, transmission, distribution and supporting activities from initial planning through daily operations. As a result, financing of the industry must necessarily go beyond project finance.

Financing for specific individual power projects is not the fundamental concern. Rather, the issue is ***how to finance development of the entire electric power industry***. Indeed, without a financially viable industry, individual project finance is not even possible. What works for individual projects does not necessarily apply to the industry as a whole. Regardless of how the industry is structured, three conditions are mandatory to obtaining private financing beyond mere loans to governments:

1. **Governments must commit to a financially independent electric power industry.** This is the necessary first step. Without it, investors will always look to the government for ultimate financial responsibility. For example, investment bankers today often seek government financial commitments before they project finance an independent power project in developing countries. Even where such financial commitments would not

be needed, a policy of noninterference with the project is required. This same principle would apply to the industry as a whole, even with full recourse financing. The industry does not have to be private, as that will often be politically difficult, but it must have credible independent finance status. The issues involved are usually far broader than those of the electric utility industry.

2. **Utilities must become economically viable.** Viability requires: (1) a customer base that is ready, willing, and able to pay the full costs of power over the long run; (2) competent management that is able to control costs; and (3) a business environment that supports private enterprise.
3. **Investors must be convinced that their return requirements will be met.** These requirements reflect the degree of risk they must assume as well as financial market conditions. Private investors often have requirements higher than what developing countries are used to paying.

Today, multilateral and bilateral organizations as well as export finance agencies are needed only to play a supporting role in private financing. However, while they no longer have the leading role they once did, they are often key to structuring financing packages and to reassuring private investors.

Environmental performance is one important area in which divergent views may have to be reconciled. As illustrated in Chapter 2, improving the environmental performance of power plants adds to the capital cost. The priority of environmental considerations, such as those addressed by clean coal technologies, varies both among countries and among the different parties involved. In order to ensure that clean coal technologies are used, governments must be willing to develop and enforce environmental standards. In countries with large and competing capital needs, that priority is subject to policy tradeoffs. Bilateral lending agencies of developed countries (such as the U.S. Export Import Bank) and multilaterals (such as the World Bank) condition their credit on environmental criteria. They are not involved, however, in all projects and, as investment rises, their share and influence will fall. The entities that build power plants—utilities and independent power developers—will meet the environmental standards imposed on them. Uncertainty about those standards, however, is an added risk which they must consider. To the extent that added environmental investment must be privately financed, it must still allow the project to earn returns to its investors adequate to attract capital in competition with other potential investments. Retrofits of environmental technologies typically do not, in themselves, earn a return and are thus typically harder to finance unless the rates for sale of the power are adjusted in some manner to earn that return.

BARRIERS TO PRIVATE FINANCING

Chapter 1 raised three fundamental questions about determining the adequacy of financing for the electric power industry. Based on the information presented in this report, conclusions in response to these questions can now be formulated.

1. Is enough capital available to meet funding requirements?

The global gross domestic product has been expanding by about 2.7 percent per year over the last decade.³ Since the ratio of gross domestic private investment to gross domestic product has remained relatively stable over this

³International Energy Agency, *1995 World Energy Outlook* (Paris, France, 1995).

period,⁴ the total global private capital market has been growing at a similar rate. At the same time, however, it is important to note that there are differences in these growth rates among countries.

The global capital markets have demonstrated great flexibility in accommodating shifts in supply and demand for capital. In part, this is possible because of the growing and immediate availability of information about the international financial markets. These markets are also very liquid, allowing money to flow rapidly across borders to wherever the return is greatest. One source of this liquidity is the large amount of funds under professional investment management. About \$20 trillion is professionally managed today, and the total is expected to grow to \$53 trillion by the year 2000.⁵ Investment managers have the sophistication and knowledge to shift funds throughout the world, and even small private investors are doing so through mutual funds. Thus, the global markets are large, growing, flexible, and liquid enough to accommodate an electric power industry need for \$2.3 trillion over the next 15 years. In addition, a portion of the total is self-financed, thus making the need more likely to be met where the capital-raising entity has the financial strength to do self-finance.

In developed countries, because most of the basic electric power infrastructure is already in place, much new investment will go toward upgrading existing systems. The expected need for electric power investment is 1.1 percent of total projected private investment in developed countries.⁶ This is not a large demand, especially considering that power sector investment during recent years has been of similar magnitude. In addition, the developed countries had real annual growth of about 2.8 percent during recent years.⁷ It should readily absorb the additional demand.

The projections developed in Chapter 2 call for a six-fold increase in electric power investment in developing countries over the 1985 to 1991 rate of development and a doubling over the 1994 investment level. Of the total future private investment in developing countries, 7.6 percent is expected to be used by the electric power sector.⁸ This is a multiple of the share of investment for electric power in developed countries. Yet, to put this in context, total real private investment in developing countries has been growing about 3.4 percent annually in recent years.⁹ Thus, at current rates, the electric power sector's needs for capital is equivalent to just over two years of the projected growth in private capital in these countries. Total projected cumulative capital investment worldwide over the period, about 81 trillion dollars, is far greater than the need for electric power. Moreover, capital is increasingly flowing across borders to countries and industries which give the best returns. Even so, the projected share of private investment for electric power in some regions is quite high.

Ultimately, electric customers must pay for the investments, regardless of how they are financed. Investment is often needed in other sectors to provide the economic basis for growth in electric power. Yet, these sectors themselves require electric power. Investments in both electric power and other sectors must work together to create economic growth. The fundamental issue for developing and transitional countries thus becomes how to

⁴International Finance Corporation, Trends in Private Investment in Developing Countries 1995, (Washington, D.C., 1995).

⁵Jacob J. Worenklein, "Financing Global Infrastructure Through the International Capital Markets," McGraw Hill Cogeneration and Independent Power Market Conference, New Orleans, April 4, 1995.

⁶See Table 5-2.

⁷International Energy Agency, 1995 World Energy Outlook (Paris, France, 1995), Table A2.

⁸See Table 5-1.

⁹Calculation based on data in World Bank, World Debt Tables 1994-95 (Washington D.C., 1995) and International Finance Corporation, Trends in Private Investment in Developing Countries 1995 (Washington, D.C., 1995).

expand total private investment (both domestic and foreign) in all sectors, with electric power investment receiving an appropriate and feasible share of the total.

A wide variety of financing mechanisms are available to access capital, and this makes it more likely that, given the right conditions to attract capital, a funding package can be developed to meet a country's particular power sector needs. As discussed in Chapter 3, the selected financing mix can be complex, depending on the type of entity raising funds. Projects with less risk can use a broad blend of financing methods, rather than focusing on a single method and capital source. Private power companies typically use a mixture of debt and equity, including their own equity capital, domestic equity and debt, equity funds from foreign direct investment or portfolio investments, and long-term international debt. In developing countries, as the need for capital outstrips available official development assistance, the entities raising capital have sought to expand their financing sources. The main shifts are from government to private financing, and from project finance to investment equity and full recourse debt.

Capital will not necessarily be available to all developing and transitional countries. Where private capital investors require a higher return on investment, perhaps 20 to 30 percent, the capital markets may be beyond the reach of countries currently dependent on subsidized development assistance at less than 8 percent interest rates. Not only do growth and investment rates vary, but developing and transitional countries generally face a unique set of economic and political risks. Several barriers may affect available funding levels and a country's ability to access private capital:

- **Specific conditions may inhibit fulfilling all power sector needs.** Since the economic, political, and regulatory situation within each country varies widely, investors will not always provide adequate capital. Nor can all countries afford projects based on private capital. As a result of all these conditions, during 1994, capital markets directed 80 percent of all private investment in developing countries to just 12 nations.¹⁰ Not all governments currently can or do provide the political, social, and economic security necessary for investor confidence, and this results in barriers to development. The lack of private investment in South Asia and the transitional countries has already been mentioned. Governments must not only commit to support private investment, such commitments must be politically feasible and credible to investors. Concerns Examples include such considerations as recent Chinese domestic and international actions, which have reduced investor confidence in whether China's markets will remain open; trade barriers between the United States and Vietnam, which have prevented investment there until only recently; political sanctions against South Africa, which have eliminated investment there by nearly all developed countries until recently; and the tendency of the financial markets to treat all Latin American countries as though they have similar economic and political circumstances, when they are actually quite different. These types of constraints can be expected to continue, albeit in different countries.
- **Even when adequate international funds are available, not enough capital may be available in domestic markets to ensure complete development.** As discussed in Chapter 4, domestic capital must be available to collateralize international private finance and provide reasonable terms on the international portion of an investment. Historically, domestic investment has averaged about 68 percent of power sector project investment.¹¹ It is unlikely that this will change dramatically in the future, and,

¹⁰The World Bank, *World Debt Tables 1994-95* (Washington, D.C., 1995).

¹¹The World Bank, Energy Series Paper #21, "Capital Expenditures for Electric Power in Developing Countries in the 1990s" (Washington, D.C., February 1990).

thus, significant levels of domestic capital must continue to be invested in the industry. In countries with extensive nationalized industries, state-owned enterprises often squeeze available domestic private capital. As many developing country domestic capital markets are embryonic in their development, this remains a barrier.

- **A country's capital market infrastructure — which includes the legal, banking, private credit rating, public financial regulatory, and accounting systems — may not support private capital formation.** Investment capital markets cannot operate without efficiently run businesses and agencies to support them on a daily basis. Credit rating agencies and public regulatory agencies must assure a good flow of information to investors while providing market discipline. Accounting practices must be up to international standards to attract international investment.
- **Financial market expertise may be inadequate in the host government, or it may not be transferred to private power developers.** In particular, a knowledge barrier exists on how to tap into international capital markets whenever a country historically has relied on official development assistance or domestic government support. As a result, investment skills and financial market infrastructures must be constantly updated. In addition, developed countries may need to provide demonstration programs on how to blend funding sources and methods and assemble a power financing package.

Globally, adequate funds and financing techniques are available to support the anticipated power sector demand. But for specific countries, not all development is likely to be funded.

2. Can all stakeholder perspectives be reconciled to finance the industry?

The following composite quotes are typical of the diverse perspectives found in the electric power industry. In addition, Table 5-3 enumerates in some detail the expectations of the international and emerging domestic capital markets for each of the stakeholders.

We're trying to develop a really great project. We've got just about everything in place — the site, the power supply contract, the technology, the fuel and the people. We've been to lots of investment bankers. The problem is: there is no money around.

-- Independent Power Developer

We work with many investors who want to put their money into good power projects. Developers also come to us with projects. The problem is: there are no good projects around.

-- Investment Banker

We need electrification in our country. We keep hearing that we must turn to foreign developers and financial institutions. The problem is: how can we be sure we will still benefit when such a vital industry is developed by foreign interests?

-- Energy Ministry Official

Table 5-3
INTERNATIONAL AND DOMESTIC PRIVATE CAPITAL MARKET
REQUIREMENTS OF STAKEHOLDERS

Stakeholder	Requirements of International Private Capital Market	Requirements of Domestic Private Capital Market
Government	<ul style="list-style-type: none"> ● Host government support for a financially independent power sector ● Satisfy foreign investors as to political and economic stability of the country ● Satisfy foreign government economic objectives 	<ul style="list-style-type: none"> ● Government support for a financially independent power sector ● Meet political needs of ruling and alternative parties to provide social and economic stability ● Plan for and encourage economic growth ● Protect national security to provide a stable domestic economy
Regulators	<ul style="list-style-type: none"> ● Satisfy investors that regulations are transparent and fair ● Satisfy foreign government environmental objectives 	<ul style="list-style-type: none"> ● Need fair regulations that apply to all competitors ● Satisfy society's environmental concerns ● Meet political needs
Power Utilities	<ul style="list-style-type: none"> ● Reliably produce electricity ● Have economic viability ● Have competent management 	<ul style="list-style-type: none"> ● Reliably produce electricity ● Have economic viability ● Have competent management
Private Project Developers	<ul style="list-style-type: none"> ● Have competent management ● Provide rapid payback and high rate of return ● Require solid information about country and its power sector 	<ul style="list-style-type: none"> ● Can influence government to maintain a stable business environment ● Have competent management ● Provide rapid payback and high rate of return
Equity Investors	<ul style="list-style-type: none"> ● Provide affordable capital ● Expect adequate return on investment with moderate risk level ● Domestic investors must provide some equity capital 	<ul style="list-style-type: none"> ● Expect adequate return on investment with moderate risk level ● Need adequate equity market infrastructure ● Expect fair treatment compared with international markets
Debt Investors	<ul style="list-style-type: none"> ● Adequate return on investment with low risk level ● Multilateral banks and bilateral agencies support industry with loans or grants 	<ul style="list-style-type: none"> ● Adequate return on investment with low risk level ● Need adequate debt market infrastructure ● Expect fair treatment compared with international markets

Reconciling these divergent concerns is not easy. Such differences are natural and make electric power financing difficult, even in developed countries. They are compounded in developing and transitional countries with long statist traditions. Resolving the differences in these countries may be a long process. It will involve cultivating relationships and developing mutual levels of comfort for all the parties. It may not always succeed and, as a result, some power "needs" may not be met.

The tension expressed between project developer and investment banker has existed for as long as people have needed to raise capital and others were willing to invest. Established mechanisms are available to resolve it. This tension, however, is particularly acute in developing and transitional countries where host government involvement and economic conditions limit the financial viability of electric power investments.

Governments of these countries, if they are interested in securing private capital, will have to remove domestic institutional barriers to agreements between parties, but, understandably, will only do so if their own needs are

met. This is an intrinsically political process. One important consideration in many countries, for example, is balancing the need to subsidize electric power for the poor with the need for adequate rates to create a viable electric power industry. In addition, removing barriers to agreements often involves a number of adverse conditions that may, at best, be only indirectly influenced by government agencies responsible for electric power. These conditions may include economic stagnation, business and cultural practices, lack of a domestic financial market, needs for management expertise, and power theft. Removing barriers may turn out to be a long process in many countries, and one that requires both domestic government leadership and assistance and understanding from outside. Such assistance, however, may not necessarily be forthcoming and firms desiring a rapid return on investment are not known for their patience. As noted in Chapter 3, some governments are already taking the necessary measures, and these will be the first to reap the benefits.

3. Can the industry meet the criteria of the private capital sources?

To meet the needs of private capital investors, all three of the financing conditions noted earlier need to be satisfied: a financially independent industry, commercial viability, and investors convinced that return requirements will be met. Not fully meeting any of these criteria raises barriers.

A financially-independent electric power industry. Such an industry is able to raise funds based on its own credit-worthiness and not that of the government. It may be composed of one or more viable electric utilities which offer an adequate rate of return to investors. This requires government non-interference with the business and operating decisions of the utility. It also requires some entity or entities to take financial responsibility for developing the country's overall power sector — and in many cases this can no longer be the host government. If it is not the government, then the private sector must provide leadership as well as capital.

When privatization of the industry is chosen, success requires government support for competition, use of hard budgets, and financial sector reform.¹² National utilities might be divided into regional utilities to foster competition. Adherence to firm budgets that eliminate government subsidies and fund transfers is essential. The financial sector can better support a privatized utility by adopting improved regulatory capacity, reducing direct credit and government control over financial sector intermediaries and easing interest rate controls.

In addition to supporting an independent power industry, the host government must proactively mitigate political risks. The political climate must minimize investment risks, such as changes in a sovereign government which might repudiate existing contracts. Regulation of the utility must be well-defined and transparent so the utility is free from interference or intervention by the host government. Finally, currency convertibility, repatriation of profits, and mitigation of currency valuation risk must be accommodated.

It is not always possible to fully resolve all conflicts between government policy and private sector needs. For example, during 1995 in India, the Houston-based Enron Development Corporation had to suspend a \$2.8 billion power project (the largest foreign investment ever in India) because of difficulty in getting Maharashtra state government approval. The stated reason was a lack of competitive bids and less-than-transparent contracts for the project. This decision was supported by all political parties in India except the central ruling Congress. Many foreign companies had been monitoring the deal as a gauge of India's commitment to open its economy to foreign investment and, as a result, have reconsidered their options. Since India cannot fully develop its power sector without extensive private investment (see Table 5-1), this capital need can only be met if government policy

¹²The World Bank, *Bureaucrats in Business: The Economics and Politics of Government Ownership* (New York: Oxford University Press, 1995), p. 13.

evolves more favorably to foreign private investment. Indeed, during January 1996, the Enron deal was renegotiated and is now proceeding under terms less favorable to private investors than originally contracted for.¹³

Another example is in China, where the government's ground rules are not yet certain enough for many investors. Meanwhile, China has a \$467 billion electric power sector need over the next 15 years. Three layers of governmental responsibility are in effect in China. At the top, the Ministry of Power Industry and four other ministry-level power bureaus provide a limited degree of central control. In the middle, nine regional power organizations establish power development companies within their jurisdiction. Similar to large utility companies in the United States, they directly control and manage the power-generating activities of their subordinate power stations. At the bottom layer, numerous provincial and municipal government bureaus and power development companies operate. Each administers the existing local power system, plans for development, and implements specific construction projects. With this multi-layered system, it is difficult for any single government entity to commit to a financially independent power industry. Approvals for development can exceed three years to complete, which makes financing more difficult. The inherent redundancy of dealing with so many governmental levels also daunts some investors.

Government interference in the private sector can result in a company's inability to manage in a business-like manner. During the development phase, for example, the Enron deal in India resulted in both a \$300 million loss to Enron and a loss of the project for Indian customers. Caps on foreign ownership levels intended to prevent dependence on foreign markets can actually impede development. Environmental controls on fuel types and emission levels can increase development costs. Government regulations during the operations phase can be so formidable as to reduce economic viability. For example, a cap on return to investors could eliminate all foreign private investment. Another example would be a sudden change in tax policy which threatens profitability. Management must be able to make independent hiring and firing decisions.

While government involvement can be harmful, this is not always the case. If the power sector is privatized, the host government may still need to remain an active player in promoting infrastructure development. This is particularly true in less financially strong or stable countries because of the higher risk to private developers. Government investment in infrastructure projects directly supports the projects and also serves to increase investor confidence. Lack of host government involvement sends negative signals to the market that political conditions may change.

Commercially-viable utilities. In general, the market has forced utilities to become economically viable as they have been privatized. For example, Argentina has been able to better maintain its power generation facilities by attracting and properly managing new domestic and foreign capital. As privatized utilities become more knowledgeable about the marketplace, they tend to set prices at rates customers are willing to pay while controlling costs to secure a profit. In addition, in a more competitive marketplace including non-integrated utilities, the market forces utilities to efficiently distribute resources between the generation, transmission, and distribution functions.

Investors convinced that return requirements will be met. To meet the criteria of private capital investors, conditions in a country must be conducive to normal business development. Specific projects (whether generation, transmission, or distribution) must be credit-worthy to receive investor support. Higher-risk projects undergo extensive scrutiny. In particular, private investors require that conditions in the country allow the power industry to operate with normal and transparent business risks, plan for and clearly define all capital needs, operate under an accepted legal framework which defines procedures for arbitration and appeal of disputes between the utility and the host government, meet credit requirements, and secure significant domestic capital

¹³Washington Post, "Wattage to India," February 5, 1996, p. A12.

market support. Additional investor concerns may or may not be met, such as guaranteeing political and economic security for the investment, and providing for currency convertibility and repatriation of profits. All of these conditions are discussed in detail in Chapter 3. Satisfying these requirements leads to investor confidence that their investment risk will provide an adequate rate of return.

Specific Barriers

Specific barriers (some of which extend beyond the electric power industry) relating to the three criteria for raising private capital occur in particular countries:

Barriers to a Financially Independent Electric Power Industry

- **The government agency with responsibility for decisions about the power industry is not always clear.** The government must identify some private or parastatal agency to coordinate the effort, as industry development it will not happen entirely through market forces. The bureaucratic nature of governments sometimes makes it difficult for any government agency to take responsibility. In China, for example, a complex mixture of entities is responsible for power development, with no one entity fully in control. The industry requires a sound regulatory environment that prevents utilities from abusing market power while offering investors sufficient return.
- **Excessive government approval requirements can stop or delay project completion.** Governments tend to overregulate because of a perceived need to control key industries. However, part of government commitment to the power sector is the elimination of unnecessary approval processes. As a counter example, recent reductions in government regulations and financial sector reform in the Philippines, Korea, Thailand, Malaysia, and Taiwan have resulted in increasing levels of private investment in the power sector.¹⁴

Barriers to Commercially-Viable Utilities

- **An adequate market for power does not always exist.** Integrated utilities normally can plan to meet the demand of a suitable customer base — that is, a reasonable level of customers willing and able to pay for electricity. However, in some countries, power is viewed as a tool for economic development. In these cases, while an adequate market exists, customers do not pay enough to make the utility viable. Unless this changes, it will not be possible to meet future demand with privately funded capital, even though the power industry may currently be successfully developed.
- **Electric power industry revenue is insufficient in some countries.** Electricity pricing and power plant operation are not always based on economic principles. Where customers have become accustomed to subsidized, low-priced power (originally offered to improve the quality of life), the future customer base may be unwilling to pay prices which are sufficient to cover costs. Subsidies can be hidden, for example via indirect low fuel prices. In China, for example, the average electricity price is 2.2 cents per kWh — partly due to price controls, and this is below production cost.¹⁵ More broadly, tariffs in a sample of 60 developing countries fell 32 percent in real terms from 5.2 cents per kWh in 1979 to 3.8 cents per kWh

¹⁴Michael T. Burr, "Powering Asia's Future," *Independent Energy*, February 1995, pp. 6-8.

¹⁵Private conversation with Gregory K. Ingram, World Bank, February 1995.

in 1988.¹⁶ This is significantly below the 8.0 cents per kWh charged in OECD countries. The utility must be able to charge adequate rates to cover all costs, develop the industry, and provide a competitive rate of return to investors.

- **Extensive power theft or poor revenue collection may make economically sustainable power sector development difficult.** Until recently, for example, many villages in South Africa simply tapped into the power grid without paying for the power. The government was either unable or chose not to enforce laws against this practice. Power theft occurs in many regions and can be significant enough to harm economic return. In addition, system losses can be excessive due to inaccurate or fraudulent billing and collection systems. For example, in Bangladesh in 1991 system losses were 43 percent when ideally they should only be 7 to 10 percent.¹⁷
- **Incentives are not offered to retain competent managers in the electric utility industry.** Usually, competent staff can be hired and trained, but incentives need to be in place to retain good employees. Among many disciplines, educated, experienced and reliable staff are needed for utility management, engineering, accounting, and legal functions. Inadequate management is one of the largest causes of enterprise insolvency. Use of regulatory contracts between host governments and privatized utilities, which reward improved performance, and penalize failure to improve, have been shown to mitigate this problem.¹⁸ Incentives also include the opportunity to act with authority, good training and adequate compensation.

Barriers to Investor Confidence

- **Host government policies are not always conducive to attracting domestic and foreign investors.** This is a problem not just with electric power investment, but generally. When one or more of the business conditions noted on page 5-11 are not met, domestic capital flight may result. For example, significant amounts of capital have flowed from Latin America into the United States during the last decade because domestic investors have been dissatisfied with the domestic risk/reward ratio. It is only in recent years, with inflation waning, that some of this capital has begun to return home. In some cases, policy changes must end subsidies so that markets can determine prices. Investors also require long-term electricity price stability. If these political decisions — which often transcend the electric power sector — are not met, then investors will not provide the capital.
- **A sufficient rate of return must be generated on each investment, but this may be beyond what host governments or utilities are willing to tolerate.** Private investors in developing countries often expect returns of 20 percent or higher to cover risks, taxes, and other uncertainties. For example, on the Enron deal in India, the rate of return was renegotiated down to 20-22 percent.¹⁹ This expectation can be a barrier, particularly when traditional multi-lateral and bi-lateral financing has been costing less than one-third of this in some countries. For example, World Bank financing typically has been available at a 7.5 percent interest rate. The resulting difference in electricity prices between subsidized rates and

¹⁶Gunther Schramm, "Issues and Problems in the Power Sectors of Developing Countries," *Energy Policy*, p. 737, July 1993.

¹⁷Ibid, p. 740.

¹⁸The World Bank, *Bureaucrats in Business: The Economics and Politics of Government Ownership* (New York: Oxford University Press, 1995).

¹⁹Washington Post, "Wattage to India," February 5, 1996, p. A12.

market clearing returns can create political difficulties for investors. In addition, some countries will likely not be able to shoulder the high costs and rates of return expected by private investors, thus creating a barrier to any investment in electric power in that country.

- **Even with solid fundamentals, entities raising capital may face unfavorable financial market treatment.** Investors from developed countries tend to make broad generalizations about regions of the world. Although a developing country may have a solid economy, it may not be perceived as stable by investors. For example, in regions such as Latin America, where some countries have fixed exchange rates and relatively high inflation levels, increased import levels normally follow. This leads to a need for more foreign currency which in turn eventually forces major currency devaluation. Investors have long memories of such cycles that make them wary of investing in a country — or any country in the region — long after an economy has stabilized. For example, some investors look at Mexico, Ecuador, Chile, and Brazil as having the same currency convertibility problem, while the situation actually varies considerably by country.

Market for Clean Coal Technologies

- **The market for clean coal technologies is determined by the sensitivity of each country to health and environmental concerns and their willingness to pay the incremental cost of clean energy.** Clean coal technologies are required to ensure that environmental standards are addressed when coal is used. In power projects, whether private or public, developers faced with constraints on capital availability or high costs of capital naturally have an incentive to minimize the initial capital cost of a project, even at the expense of the environment. This incentive to minimize capital costs may be particularly strong in countries making the transition from lower-cost official finance to higher-cost private finance.

This appears to be a long litany of barriers. They all exist to some degree, but they do not all apply uniformly to all countries. Moreover, many countries are actively moving to reduce them. The situation is very region- and country-specific.

MITIGATING BARRIERS TO PRIVATE FINANCING

Policy decisions by the governments of developing and transitional countries are critical to obtaining private financing for the electric power sector. The governments must decide whether they really want private investment in electric power. If so, they must commit to fostering the conditions necessary to facilitate it. While this often entails difficult political decisions, if such conditions are created, the investment will follow to the extent that economic conditions permit. This obviously involves considerations for the host government that go well beyond the power sector.

In this situation, all that the U.S. government, other developed-country governments, and multilateral banks can do is:

1. Encourage the governments of developing and transitional countries to facilitate institutional and economic conditions favorable for private investment,
2. Where requested, provide information and advice to the countries desiring to facilitate these favorable conditions, and

3. Ensure that bilateral and multilateral funding sources are available, where needed, to supplement private finance.

Specific measures to implement these strategies are described below. In addition, more attention needs to be given to the broader financing issues. With the scrutiny that international private power development has received in recent years and the importance placed by developed countries on promoting the needs of their project developers, it is not surprising that the central focus has been on project finance. Yet, until the broader institutional and financial issues are resolved, project finance will not be feasible in many developing and transitional countries, except in a limited number of the most favorable situations.

Strategies to ensure financing should take into account varying financial conditions in different countries. Countries differ widely in their ability to finance the electric power industry. Rapidly-industrializing countries, including many found in East Asia, for example, differ greatly from most of the developing countries in Africa. The lack of overall private investment is a problem in many countries. Considerable variation exists even within the same geographic region. Risk levels directly affect the cost of capital for each country and, in turn, risk depends on many factors such as economic growth, political stability, and government commitment to free markets rather than subsidized industry. As a result, a different mixture of financing sources and methods is most appropriate to each country. For example, to meet their electric power development financing needs, lower income countries may need more official development assistance than projected on average in this report. Alternatively, rapidly-industrializing countries with privatized electric industries might be able to raise even more private capital than needed, thus using less official development assistance than projected.

Developed-country governments and multilateral banks can use several strategies to help developing and transitional countries overcome these barriers:

- **Develop programs to bring together key players with differing perspectives on financing.** These programs may include conferences, trade missions related to financing, and meetings. Varying energy policies and private capital available to each country suggest the need for more communication, exchange of ideas, and rationalization of policy among countries. Information interchange can help mitigate the differences and stimulate creativity and thus increase the total number of power projects that will be financed. Such communication activities might be coordinated with bilateral and multilateral organizations that also have a stake in reconciling the varying perspectives.
- **Encourage host governments to facilitate a financially-independent electric power industry.** Entities must be found or created to take the lead in developing the industry. Then host governments must support these power development entities by creating appropriate financial and regulatory policies and communicating them to the marketplace. Such policies may include eliminating price and interest rate controls, foreign ownership caps, return caps, and excessive approval processes. Some host governments must also commit to policies that support improvements in their legal, banking, credit rating, financial regulatory, and accounting systems. Encouragement can be as simple as discussing with host governments specific ways to implement policies that support private investment. Developed countries and host governments might also seek ways to jointly reduce currency valuation and convertibility risks, or at least support trade, tax, and interest rate policies that make currencies more stable. In addition, host governments must be encouraged to set policies that eliminate power theft and reduce system losses, and to train utilities to set economically viable prices.
- **Educate electric utilities in how to create commercially-viable utility businesses.** Educational programs for entities raising capital should also cover how to tap into the international capital markets. Already, there is evidence that some firms in Malaysia, Singapore, and Hong Kong are using new

acquired knowledge about how Western power projects work to compete for project opportunities outside their own borders.²⁰ In addition, the United States and other developed countries could communicate timely and accurate data about developing-country economic, social, and political conditions, along with information about the country's electric power sector development needs. This would increase international investor confidence in the country while helping investors focus efficiently on key markets. Finally, in some cases, basic management training would be helpful.

The U.S. Agency for International Development (USAID) is currently doing some of this. For example, the Volunteers in Overseas Cooperative Assistance program assists the spread of rural electrification in developing countries. This program currently supports technology transfer and information exchange in 15 countries. However, it may be necessary to further develop U.S. government expertise and capability in international power sector finance to include the current status of official development assistance and private capital markets, electric power sector development needs, and how to lead and finance a power industry. The U.S. electric utility industry could provide some valuable lessons in these areas.

- **Support multilateral lending to developing countries for privatization of electric power.** In addition to directly providing seed funding for specific projects, properly directed multilateral aid both enhances economic and political stability and supports privatization efforts. As one recent example, India has unilaterally reduced its trade barriers in response to World Bank adjustment lending.²¹ Multilateral aid can also reduce instability resulting from excessive tied-aid credits and competition with bilateral aid. An example here is the \$1 billion lent to Mexico by the World Bank in 1995 to assist in restructuring the banking sector and provide financial reform. This was coupled with a \$500 million loan to support essential social programs designed to protect the poor from the effects of the currency crisis. The enhanced economic and political stability which results from such multilateral assistance encourages private capital formation.
- **Enhance programs to support sound economic principles in the power industry.** Bilateral aid provides seed funding which supplements and encourages but does not compete with private capital. In addition, conditions tied to bilateral aid can promote policy reform and institutional development. Appropriate bilateral technical assistance may encourage host governments to support a commercially viable, financially independent electric power industry. Therefore, bilateral aid should continue to be offered wherever it is suitable. Some existing USAID programs, such as the Utility Partnership Program in Eastern Europe, will need little modification to work well in the changing marketplace. This type of program can also be applied in other regions. Other programs should be reviewed to determine if they remain effective catalysts when developers create complex power sector funding packages.
- **Coordinate activities of U.S. agencies and multilateral development banks to facilitate domestic and international private capital formation.** At times, U.S. agencies and multilateral banks support the same project, with the combined aid being greater than is necessary to attract private capital. This means that less aid is available to attract private investors to other power projects. With dwindling official development assistance and increasing needs that must be met by private capital markets, better coordination of funding efforts will benefit all.

²⁰Michael T. Burr, op. cit.

²¹Lawrence Summers, "Are Multilaterals the Solution?," *The Wall Street Journal Europe*, October 13, 1995.

Actions can also be initiated to specifically ensure that clean coal technologies are used and their environmental benefits are realized:

- **Continue efforts to reduce the capital costs of clean coal technologies.** Further development of these technologies to reduce the incremental capital cost and adapt them to individual country conditions would ensure greater penetration and reduce environmental impacts. One option that may have a high payoff would be technologies that have lower total emission reductions, but which have a much lower cost per unit of pollutant removed. Several such technologies were initially demonstrated as part of the U.S. Clean Coal Technology Demonstration Program.
- **Develop financing programs to reduce the incremental capital costs of clean coal technologies.** This will require the involvement of bilateral and multilateral organizations. Since these organizations can only provide a share of the total financing, such an application would be an appropriate use of their funds. Such organizations are already aware of the benefits of clean coal technologies and have environmental mandates and funding programs. Multilateral banks are also particularly important to involve because they are also frequently involved early on in the development process when CCTs may first be considered. It is currently anticipated that the next report in this series will address this issue.
- **Assist developing and transitional countries to develop emissions standards that promote environmental benefits.** Many countries are now working to put such standards into place. They must balance many factors in developing such standards.

GLOSSARY

American Depositary Receipts (ADR) Depositary receipts issued by an American bank to assist trading of a foreign stock or share. The U.S. bank issues an ADR against underlying securities deposited in the bank or its custodian bank abroad.

Bilateral Loans Loans from governments and their agencies (including but not limited to), official export credit agencies, central banks and foreign assistance agencies.

Bond A Bond is an interest-bearing debt instrument, the issuer writes a contract to pay the lender a fixed principal amount at a stated future date as well as a series of interest payments until the bond matures.

Brady Plan An agreement in 1989 for the restructuring of developing country debt. The plan set priority of future payments to loans made by multilateral development banks and provided for discounted immediate payments to bank lenders on existing debts which were in default. It also collateralized much of the remaining debt, which allowed its sale by the banks to other investors. It also required developing countries to carry out structural economic reforms to ensure future economic stability.

Capital Flows The movement of capital between countries.

Capital Market Markets where corporations and governments raise funds by selling securities to investors, and various types of bonds, debentures, stocks are traded in this market.

Clean Coal Technology (CCT) Technologies that allow coal to be utilized cleanly and efficiently.

Commercial Credit, or Commercial Loan Credit or loan given by private banks and other private institutions.

Concessional Loans Loans by governments or Multilateral Development Banks at below market interest rates or under other favorable terms and conditions not available in the commercial marketplace.

Consumer Contribution Payments towards the development of a power project by the current or future consumers of the electricity the project will provide.

Cross Border Private Debt Private debt owed to creditors outside the host country's national borders.

Currency Convertibility The ability of a country's currency to be converted to the currency of other countries.

Debt Money, merchandise or services owed to an individual or organization, through an explicit or implied agreement that establishes the legal ground for settlement of the claim.

Domestic Capital Investments provided by citizens of the host country.

Equity Common and preferred stock.

Export Credit Loans by governments to encourage export. Governments give credits to foreign buyers to help

them buy goods and services of the exporting country.

Foreign Direct Investment (FDI) Investment that is made to acquire a lasting management interest (usually at least 10 percent of voting stock) in an enterprise operating in a country other than that of the investor, with the investor having an effective voice in the management of the enterprise. It may consist of equity, reinvested earnings, other long-term capital, and short-term capital as shown in the balance of payments.

Full Recourse Debt Debt in which the lender has a general claim against the parent company if the collateral is insufficient to ensure its repayment.

Global Depository Receipts (GDR) Depository receipts issued by a bank to assist trading of a foreign stock or share. The bank issues a GDR against the underlying securities deposited with the bank or its custodian bank abroad.

Gross Domestic Investment Private and public sector investment in a country, excluding foreign direct investment.

Host Government The government of the country in which an entity to be financed is to be located.

Lending To provide someone with funds with the agreement that it will be repaid, usually with interest.

Multilateral Development Banks International financial institutions owned by multiple countries that provide financial and technical assistance to less-developed nations. These institutions raise money primarily from the direct contributions of financially capable members or from borrowing in the capital markets.

OECD Organization for Economic Co-operation and Development.

Official Finance Credits, equity, insurance or grants provided by the government of a country other than the host country or a Multilateral Development Bank.

Parastatal An organization owned and controlled by the government that is engaged in productive activity.

Portfolio Equity Flows The sum of country funds, and direct purchases of stock or depository receipts (American or global) shares by foreign investors.

Portfolio Investment Investment in financial instruments, such as stocks and bonds, as contrasted to direct investment in a factory or business enterprise.

Private Loans Loans from private investors, such as banks, insurance companies, or individuals.

Privatize To change, from governmental or public ownership or control to private ownership and control.

Project Finance Debt that is a claim against the cash flow from a project rather than against a firm's entire assets.

Repower To modify an existing power plant by changing the method used to generate power. Repowering may modernize the powerplant, increasing its efficiency, lower operating costs and/or increasing output.

Retrofit To substitute new or modernized parts or systems in a powerplant for older equipment.

Self Finance Use of a firm's net internal funding originating from operations (after debt service) to finance a new project.

Sovereign Finance Raising of capital by the host government, typically through taxes and/or bond issues.

Vendor/Supplier Credit Export finance made available to the purchaser by the supplier of the goods.

Wheeling The process of trading electricity across transmission facilities that are owned by third parties.